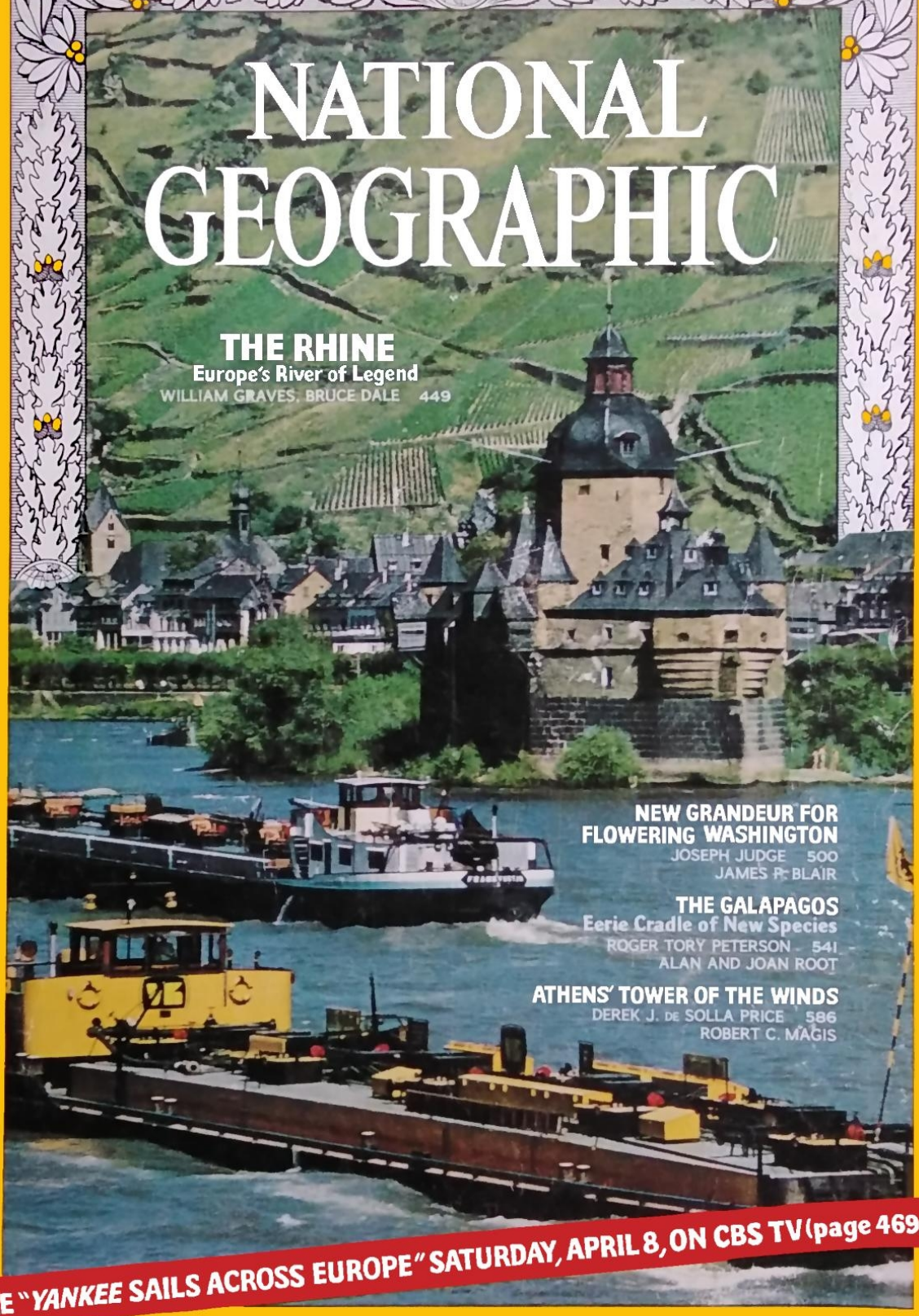
VOL. 131, NO. 4 APRIL, 1967

NATIONAL GEOGRAPHIC



THE RHINE
Europe's River of Legend
WILLIAM GRAVES, BRUCE DALE 449

NEW GRANDEUR FOR FLOWERING WASHINGTON
JOSEPH JUDGE 500
JAMES P. BLAIR

THE GALAPAGOS
Eerie Cradle of New Species
ROGER TORY PETERSON 541
ALAN AND JOAN ROOT

ATHENS' TOWER OF THE WINDS
DEREK J. DE SOLLA PRICE 586
ROBERT C. MAGIS

SEE "YANKEE SAILS ACROSS EUROPE" SATURDAY, APRIL 8, ON CBS TV (page 469A)

THE JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D. C.

NATIONAL GEOGRAPHIC APRIL, 1967
RHINE RIVER WASHINGTON GALAPAGOS TOWER OF THE WINDS

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

Organized "for the increase and diffusion of geographic knowledge"

GILBERT HOVEY GROSVENOR
President, 1920-1954, Editor, 1899-1954
Chairman of the Board, 1954-1966

The National Geographic Society is chartered in Washington, D. C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization for increasing and diffusing geographic knowledge and promoting research and exploration. Since 1890 the Society has supported 371 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; more than 26 million maps distributed each year; its books, globes, and atlases; 30 School Bulletins a year in color; information services to press, radio, and television; technical monographs; timely exhibits from around the world in Explorers Hall; and now a nationwide series of programs on television.

Articles and photographs of travel, natural history, and expeditions to far places are desired. For material used, generous remuneration is made.

MELVILLE BELL GROSVENOR, President and Editor
MELVIN M. PAYNE, Executive Vice President and Secretary
ROBERT V. FLEMING, Vice President and Treasurer
FREDERICK G. VOSBURGH, Vice President and Associate Editor
LEONARD CARMICHAEL, Vice President for Research and Exploration
ROBERT E. DOYLE, Vice President and Associate Secretary
THOMAS M. BEERS, Vice President and Associate Secretary
GILBERT M. GROSVENOR, Vice President and Senior Assistant Editor
VERNON H. BREWSTER, OWEN R. ANDERSON, HERMAN J. A. C. ARENS, WM. T. BELL, HERBERT T. HENDERSON, W. E. ROSCHER, C. VERNON SANDERS, Associate Secretaries
HILLEARY F. HOSKINSON, Deputy Treasurer and Assistant Secretary
ARTHUR B. HANSON, General Counsel

COMMITTEE FOR RESEARCH AND EXPLORATION

LEONARD CARMICHAEL, Chairman

ALEXANDER WETMORE	T. DALE STEWART
Vice Chairman	Senior Scientist
MELVIN M. PAYNE	Office of Anthropology
Vice Chairman	Smithsonian Institution
Rear Adm. L. O. COLBERT	MATTHEW W. W. STIRLING
CARYL P. HASKINS	Research Associate Smithsonian Institution
A. REMINGTON KELLOGG	JAMES H. WAKELIN, JR.
Research Associate Smithsonian Institution	CONRAD L. WIRTH
Vice Adm. EMORY S. LAND	PAUL. A. ZAHL

and the Senior Officers of the Society
BARRY C. BISHOP, Secretary

BOARD OF TRUSTEES

THOMAS W. McKNEW, Chairman of the Board, formerly Executive Vice President and Secretary (1932–1962)

LEONARD CARMICHAEL	MELVIN M. PAYNE
Vice President, National Geographic Society	Executive Vice President
LEO OTIS COLBERT	National Geographic Society
Rear Admiral, U. S. Coast	LAURANCE S. ROCKEFELLER
and Geodetic Survey, Retired	Chairman of the Board, Rockefeller Brothers
ROBERT V. FLEMING	Inc., and President Jackson Hole Preserve
Advisory Chairman of the Board and	JUAN T. TRIPPE
Chairman, Executive Committee	Chairman of the Board
Riggs National Bank	Pan American World Airways
CRAWFORD H. GREENEWALT	FREDERICK G. VOSBURGH
Chairman of the Board, E. E. du Pont	Assoc. Editor, National Geographic
de Nemours & Company	JAMES H. WAKELIN, JR.
GILBERT M. GROSVENOR	Former Asst. Secretary of the
Senior Assistant Editor, National Geographic	Navy for Research and Development
MELVILLE BELL GROSVENOR	EARL WARREN
Editor, National Geographic	Chief Justice of the United Stares
CARYL P. HASKINS	JAMES E. WEBB
President, Carnegie Institution of Washington	Administrator, National Aeronautics and
EMORY S. LAND	Space Administration
Vice Admiral, U. S. Navy, Retired	ALEXANDER WETMORE
Formerly Pres., Air Transport Assoc.	Research Associate, Smithsonian Institution
CURTIS E. LEMAY	LLOYD B. WILSON
Former Chief of Staff, U. S. Air Force	Honorary Board Chairman,
H. RANDOLPH MADDOX	Chesapeake & Potomac Telephone Co.
Vice President, American Telephone	CONRAD L. WIRTH
& Telegraph Company (Ret.)	Former Director, National Park Service
WM. McCHESNEY MARTIN, JR.	U. S. Department of the Interior
Chairman, Board of Governors	LOUIS B. WRIGHT
Federal Reserve System	Director, Folger Shakespeare Library
BENJAMIN M. McKELWAY	WILLIAM H. McCAULEY
Editorial Chairman, *Washington Star*	Ass. Treasurer

Asst. Secretaries: CHARLES P. BIXEL, FRANK S. DELK, JOSEPH B. HOGAN, RAYMOND T. McELLIGOTT, JR.

HERMAN J. A. C. ARENS, Executive Assistant, LEONARD J. GRANT, Editorial Assistant, and Judith N. Dixon, Secretary to the President and Editor; Lenore W. Kessler, Secretary to the Chairman of the Board

◄**COVER:** Rhine River freighters thread a vineyard clad gorge in West Germany beside the Pfalz, and abandoned castle near Oberwesel (map, page 465).

Copyright © 1967 National Geographic Society, 17th and M. Streets N.W., Washington, D. C. 20036. All rights reserved. Reproduction or use of the whole or any part of the contents without written permission is prohibited. Printed in U.S.A. Second class postage paid at Washington, D.C. and at additional mailing offices. Cover design and title protected by international trademark. $8.00 a year, $1.00 a copy.

NATIONAL GEOGRAPHIC MAGAZINE

MELVILLE BELL GROSVENOR, Editor
MELVIN M. PAYNE, Executive Vice President
FREDERICK G. VOSBURGH, Associate Editor
FRANC SHOR, Associate Editor

EDITORIAL STAFF

Senior Assistant Editors: Allan C. Fisher, Jr., Gilbert M. Grosvernor, John Scofield
Assistant Editors: Andrew H. Brown, Newman Bumstead, James Ceruti, Robert L. Conly, Edward J. Linehan, Kenneth MacLeish (Foreign Staff), Carolyn Bennett Patterson, Howell Walker, Kenneth. F. Weaver
Senior Staff: Lonnelle Aikman, Jules B. Billard, Leonard J. Grant, William Graves, Stuart E. Jones, Robert P. Jordan, Joseph Judge, Nathaniel T. Kenney, Howard La Fay, Samuel W. Matthews, Bart McDowell; Senior Natural Scientist: Paul A. Zahl.
Foreign Staff: Luis Marden (Chief); W. Robert Moore (Emeritus), Thomas J. Abercrombie, David S. Boyer, Helen and Frank Schreider, Volkmar Wentzel; Kip Ross (Research)
Editorial Staff: Wayne Barret, Thomas Y. Canby. Louis de la Haba, Rowe Findley, Joanne M. Hess, Werner Janney, Jay Johnston, Elizabeth A. Moize, O. Mac White, Peter T. White; Virginia H. Finnegan, Alice J. Hall, Winifred M. Myers, Shirley Neff, Betty T. Sanborne (Assts.), Dorothy M. Corson (Indexes), Rosalie K. Millerd, Jeanne S. Duiker (Files); Mary W. McKinney
Editorial Layout: Howard E. Paine (Chief); Charles C. Uhl, John M. Lavery
Book Service: Merle Severy (Chief); Edwards Park (Assoc. Chief); Seymour L. Fishbein (Asst. Chief), Thomas B. Allen, Ross Bennett, Charles Hyman, James P. Kelly, Anne Dirkes Kobor, Patricia Coyle Nicholson, John J. Putman, Betty L. Reece, Jr., David P. Robinson
Geographic Art: Newman Burnstead (Chief), William Palmstrom (Asst. Chief). *Artists:* Lisa Biganzoli, Gilbert H. Emerson, Victor J. Kelley, John W. Lothers, Robert C. Magis, Robert W. Nicholson, Isaac Ortiz. *Research:* George W. Beatty, Walter O. Crowe, John D. Garst, Jean B. McConville, Dorothy A. Nicholson, Eugene M. Scheel, John P. Wood. *Special Publications:* Robert L. Breeden (Chief); Donald J. Crump (Asst. Chief), Bruce Brander, Johanna G. Farren, Mary Ann Harrell, Geraldine Linder
Editorial Research: Margaret G. Bledsoe (Chief); Ann K. Wendt (Asst. Chief), Edith C. Berg, Abigail T. Brett, Ledlie L. Dinsmore, Margery G. Dunn, Jan Holderness, Levenia Loder, Elisabeth J. Norton, Frances H. Parker, Patricia Rosenborg, Elisabeth C. Wagner.
Geographic Research: George Crossette (Chief); Newton V. Blakeslee (Asst. Chief), Leon J. Canova, Margaret Ladd, Virginia A. LeVasseur, John A. Weeks.
School Service: Ralph Gray (Chief); Arthur P. Miller, Jr. (Asst. Chief), Lea Ridgley Fuller, Charles H. Sloan, Janis Knudsen Wheat.
News Service: Windsor P. Booth (Chief); Matt C. McDade (Asst. Chief), Edward Cornish, Sabin Robbins, Paul Sampson, Isabel Clarke (Asst.). *Television Service:* Robert C. Doyle (Chief); Dennis B. Kane (Asst. Chief), David Cooper; Patricia F. Northrop (Asst.)
Phototypography: Robert C. Ellis, Jr. (Chief); John McConnell (Asst. Chief), Elizabeth L. Donley.
Library: Virginia Carter Hills (Librarian); Margery K. Barkdull (Asst. Librarian), Melba Barnes, Vera Cassilly, Katharine P. O'Donnell, Louise A. Robinson, Esther Ann Manion (Librarian Emeritus)
Editorial Administration: Patricia M. Watkins

ILLUSTRATIONS STAFF

Illustrations Editor: Herbert S. Wilburn, Jr.
Associate Illustrations Editor: W. E. Garrett. *Art Editor:* Andrew Poggenpohl. *Asst. Illust. Editors:* Mary S. Griswold, Thomas R. Smith, Charles Allmon (Incoming Photographs). *Layout and Production:* Arthur A. Terry. *Director of Photography:* Robert F. Gilka. *Asst. Dir:* Joseph Baylor Roberts. *Film Review:* Albert Moldvay (Chief); Guy W. Starling (Asst. Chief). *Photographers:* B. Anthony Stewart (Chief); William Albert Allard, James P. Blair, Dean Conger, Bruce Dale, John E. Flecher, Otis Imboden, Bates Littlehales, George F. Mobley, Winfield Parks, Joseph J. Scherschel, Robert F. Sisson. *Picture Editors:* Bryan Hodgson, O. Louis Mazzatenta, Charlene L Murphy, Robert S. Patton, Jon T. Schneeberger. *Librarian:* Alan J. Lessel, Barbara A. Shattuck (Asst). *Photo Lab:* Edwin I. Wisherd (Chief); Milton A. Ford, Donald McBain, Robert S. Oakes, Claude E. Petrone, Carl M. Shrader.
Pictorial Research: Walter Meayers Edwards (Chief). *Artists:* Walter A. Weber (Naturalist), Peter V. Bianchi. *Engraving & Printing:* Dee J. Andella (Chief); Joe M. Barlett, Frank S. Oliverio, William W. Smith, James R. Whitney

CARTOGRAPHIC STAFF

Chief Cartographer: Wellman Chamberlin
Associate Chief Cartographer: Athos D. Grazzini
Asst. Chief: William T. Peele. *Base Compilation:* Charles L. Stern (Supervisor); James W. Killion. *Name Compilation:* Richard J. Darley (Supervisor); Donald A. Jaeger, Manuela G. Krigutowicz, George E. Stuart. *Map Drawings:* Douglas A. Strobel (Supervisor), John J. Brebin, Robert W. Northrop, Thomas A. Wall. *Map Editing:* Ted Dachtera (Supervisor); Russel G. Fritz, Richard K. Rogers, Thomas A. Walsh. *Projections:* David W. Cook. *Layout and Design:* John F. Dott, Harry C. Siddeley. *Administrative Assistant:* Catherine M. Hart

SECRETARY'S STAFF

Administrative: Edwin W. Snider, Richard E. Pearson. *Accounting:* Jay Givans, George F. Fogle, Alfred J. Havre, William H. McGhee, Martha Allen Baggett. *Statistics:* Everett C. Brown, Thomas M. Kent. *Procurement:* J. P. M. Johnston, Robert G. Corey, Sheila H. Immel, Margaret A. Shearer. *Membership Research:* Charles T. Kneeland. *Membership Fulfillment:* Roy J. Klockenbrink. *Member Relations:* Paul F. Moize. *Computer Center:* John Goedel. *Secretary's Files:* Mozelle L. Downs. *Promotion:* Stan Jennings, F. M. Pusey, Jr., Gordon Young, Phyllis Greene. *Personnel:* James B. Mahon, Adrian L. Loftin, Jr., Nellie F. Sinclair, T. Joyce Watts. *Medical:* Thomas L. Hartman, M. D. *Explorers Hall:* T. Kesler Bentley (Curator-Director)

EUROPEAN OFFICE

W. F. Roscher (Associate Secretary and Director), 11 Stanhope Gate, Mayfair, London, W 1, England

PARIS OFFICE

Jacques Ostier, 6 rue des Petits-Pères, Paris 2e, France

ADVERTISING

Director: Harley L. Mt Devitt, 630 Fifth Ave., New York, N. Y. 10020. *Managers – Eastern:* William A. Boeget, Jr.; *Asst. Eastern:* John R. Weist, New York. *Midwestern:* William Turgeon, Chicago. *Los Angeles:* Jack V. Sheehan. *San Francisco:* Thomas Mattz. *Automotive:* Joseph T. Fenney, New York. *Travel:* Robert W. Horan, New York

The ornithological odyssey of Roger Tory Peterson

LIFELONG ADVENTURE began for an 11-year-old back in 1919 when he joined a Junior Audubon Club and fell under nature's spell. Every free hour he tramped the woods and fields near his home in western New York. When he decided that books of those days didn't help much in recognizing birds on the wing, Roger Tory Peterson found his life's work.

Studying under ornithologists and artists, he developed a simple method for identifying each species by its shape and markings. His field guides, published in 14 languages and often illustrated with his own paintings, have made bird-watching a hobby for millions.

Dr. Peterson has carried his quest for birds to every continent. GEOGRAPHIC readers will recall his articles on cattle egrets, storks, and birds of southern Spain. He contributed to the Society's two-volume work on birds of North America.

Now this modern Audubon turns to the living laboratory of the Galapagos Islands and the strange animal life that stimulated Charles Darwin to ponder how species evolve. This world of astonishingly tame creatures — like the immature frigatebird at left — unfolds on pages 538-81.

Readers join such eminent authorities on the high road to knowledge in every issue of the GEOGRAPHIC. Won't you direct your friends to Society membership by filling in the form below?

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

CHECK ONE ▼

Mail to: The Secretary, National Geographic Society
Washington, D. C. 20036

$6.50 **CALENDAR YEAR 1967 MEMBERSHIP DUES INCLUDE SUSCRIPTION TO THE NATIONAL GEOGRAPHIC.**

Annual dues in the United States and throughout the world are $6.50 U.S. funds or equivalent. To compensate for international postage and exchange differentials, please remit: for Canada, $7.60 Canadian funds ($7 U.S. acceptable); for all other countries, $8 U.S. funds or equivalent. 80% of dues is designated for subscription to the magazine.

Life membership for U.S, and its outlying areas, $150 U.S. funds or equivalent; for Canada, $162 Canadian funds ($150 U.S. acceptable); for all other countries, $200 U.S. funds or equivalent. Remittances should be sent direct to National Geographic Society.

4-67

I NOMINATE for Society membership the person named at left. (Use separate sheet for additional nominations.) ☐

(GIFT MEMBERSHIP) I nominate and enclose $_____ for dues of the person named at left. Send gift card signed: ☐

. . . . . .

I DESIRE INFORMATION concerning membership and the NATIONAL GEOGRAPHIC. (Fill in at left.) ☐

NEW MEMBER_____
PRINT NAME OF AN INDIVIDUAL ONLY (MR., MRS., MISS)

_____
STREET

_____
CITY, STATE, ZIP CODE

MY NAME_____
PLEASE PRINT (MR., MRS., MISS)

_____
STREET

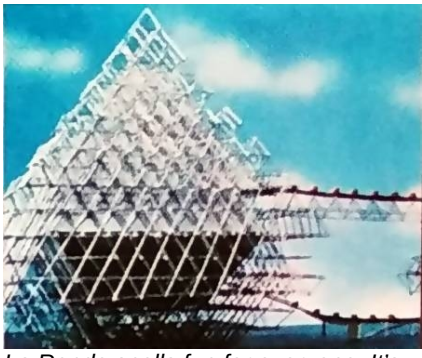
_____
CITY, STATE, ZIP CODE

See Canada and the world at Expo 67. The greatest world exhibition ever opens April 28th in Montreal, Canada.

Snap the gilded magnificence of a Buddhist shrine from Thailand. Go on an intriguing visit to the Soviet Union. Take an African safari. In the National Pavilions you'll see how people from all over the world work and play.

"Man the Producer" is one of 11 pavilions devoted to the Expo 67 theme, "Man and his World". Dive to the ocean floor, soar to the moon and go on a fascinating voyage of discovery in every dimension of human endeavour.

During Expo 67, Montreal is the stage for the world' greatest performers at the World Festival. Samples of the fabulous entertainment events are The Bolshoi Opera, the Australian Ballet, the Théâtre de France and The Japanese Kabuki Theatre.



La Ronde spells fun for everyone. It's 135 acres of enchantment featuring an old French Canadian village, an aquarium and hundreds of other attractions. Here is the Gyrotron, a ride that spirals you through outer space and plunges you into a volcano.

For six months, Canada's fair city plays host to the world at Expo 67. Some seventy nations are participating in the only first category world exhibition ever in North America. From around the globe, people are joining hands to present an all-encompassing look at "Man and His World". Call your visit to Expo 67 a glimpse of the future; a carefree trip abroad; a college education in days; the year's most exciting vacation; or a real ball. Whatever you call it, you won't forget it!

Expo 67 tickets, called Passports, are available at reduced advance prices until April 27th. Buy them wherever you see the Expo 67 sign. Seven-Day Passports, good for every single exhibit, cost $8.50 (U.S. funds) — a saving of $3.00.

Accommodations? No problem. LOGEXPO guarantees you a place to stay at government-controlled rates. Write LOGEXPO, Expo 67, Montreal, P.Q. Canada. Say when you plan to come, for how long, and the accommodations you prefer.

expo67
MONTRÉAL CANADA

The Universal and International Exhibition of 1967, Montreal, Canada / APRIL 28–OCTOBER 27, 1967

© Copyright 1963 by the Canadian Corporation for the 1967 World Exhibition

The 6-months' forecast this summer is FAIR! The theme of Expo 67 is "Man and his World", seen through the exhibits and pavilions of more than 70 nations. The spectacular Canadian pavilion, shown above, is the largest at the fair.

Boulevards, sidewalk cafes, flower stalls and kiosks create an enchantment about the city, reminiscent of Paris. Outdoor concerts are also a part of Montreal's summer evening scene.

Montreal gets its name from its beloved mountain, Mont Réal. Generations of "Montréalais" have enjoyed this lofty, green oasis in the heart of their city. You can scale this mountain on foot, by car or by bus… but traditionally, a horse and buggy is the only way to go.

The youth wave has swept Montreal's clubs and cabarets! The Beat is the Beat, wherever you go, but Montreal, with typical Gallic enthusiasm, offers a little more variety in after-hours entertainment.

Have you ever tasted onion soup, Quebec-style? Or Perdrix au Chou? Or Tourtière? You should try these typical French-Canadian gastronomic delights, served in a special French-Canadian way.

Watch out Paris! The artistry of Montreal's youthful and talented fashion designers is just beginning to surface on the international fashion scene You see the signs of it everywhere... in dozens of charming little boutiques that are springing up like flowers around downtown Montreal. Some are decidedly mod… some not-so-mod. But all are mandatory visits for fashion-conscious women.

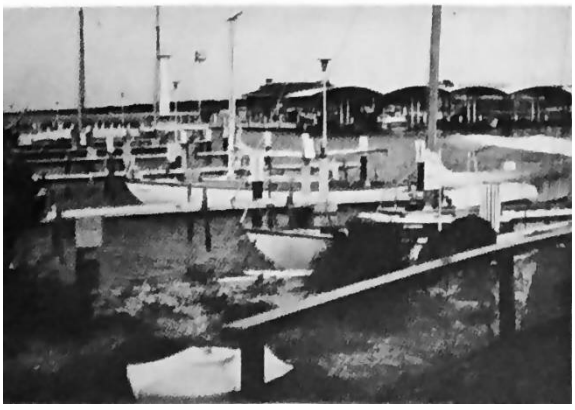
Now the whole world knows what Montrealers have suspected all along… that Montreal is not only a beautiful city, but intriguing for newcomers to explore. It's the perfect site for Expo 67! You'll want to see the old section of the city, with its fascinating reminders of the early French missionary days. Yet, only minutes away, is the dramatic contrast of modern Montreal, with its towering buildings, its Place Ville Marie, its famous shops and restaurants. The first newcomer to be intrigued by Montreal was Jacques Cartier way back in 1535. He was sold on the spot. And all he saw was possibilities.

GULF COAST

It's truly America's Riviera! Bordering the Gulf of Mexico are 50 miles of beaches, luxurious accommodations, fine restaurants, golf courses, historical sites — fun for all ages, all pocketbooks. Enjoy a really different seacoast vacation this year on the Mississippi Gulf Coast.

MISSISSIPPI

150th ANNIVERSARY YEAR



BOOKS...

published by and available only from the National Geographic Society

009 THIS ENGLAND	$11.95
007 WATER, PREY, and GAME BIRDS with record album	11.95
006 SONG AND GARDEN BIRDS with record album	11.95
051 Above two bird books ordered together	19.95
016 GREAT ADVENTURES	7.95
018 MEN, SHIPS, and the SEA	9.85
003 AMERICA'S HISTORYLANDS Landmarks of Liberty	11.95
004 AMERICA'S WONDERLANDS New Enlarged Edition	9.95
005 Above two books in combined boxed edition	23.00
020 WILD ANIMALS of North America	7.75
014 MAN'S BEST FRIEND Revised "Book of Dogs"	9.85

The above is a partial listing. Write to the Society for a free catalog of all publications. United Kingdom members may obtain the Society's publications from its office at 11 Stanhope Gate, Mayfair, London, W. 1.

Order from Department 356:

NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C. 20036

April, 1967

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 131, NO. 4 COPYRIGHT © 1967 BY NATIONAL GEOGRAPHIC SOCIETY, WASHINGTON, D. C. INTERNATIONAL COPYRIGHT SECURED

THE RHINE

Europe's River of Legend

By WILLIAM GRAVES

National Geographic Senior Staff

Illustrations by National Geographic photographer BRUCE DALE

HER NAME WAS INGRID and she was a typical Rhinelander — well-scrubbed, shining, and slightly plump. I met her in Cologne with a German boy about her age on their way downriver toward the sea.

The boy was plainly smitten. "*Schön, nicht*?" he asked proudly. "Have you ever seen such beauty?"

It was an embarrassing question, for along the Rhine River there are a good many just like Ingrid, even down to her size — 1,340 tons. And besides, I hadn't yet learned to recognize beauty in a snub-nosed lumbering Rhine freighter. So I merely smiled. As a sailor I have learned not to argue with a man about his ship.

I have also learned not to argue about the Rhine itself; those who live by it are not entirely reasonable. For one thing, they think it's the only river in the world. Of course that's nonsense. It's merely the greatest. Not the longest, it's true, nor perhaps even the prettiest — though there are some in the Rhine Gorge who will argue that. Nor the swiftest, the mightiest, the broadest, nor the deepest. Just the greatest. I'll try to explain.

The fact is I'm prejudiced, though it didn't happen all at once: It took time and 820 miles — the length of the Rhine. It took days spent with Dutch stevedores, German river pilots, and French tug captains, to mention a few. It took other companions — glasses of chilled Riesling wine, loaves of dark German bread, and a particular fondue that only a Swiss could make. It took ghostly mornings on a river seething with mist, and other mornings bright as a Rhine ship's bell.

Six Countries Share Rhine Shores

Prejudice aside, the Rhine is a great river. From its source high in the Swiss Alps to its mouth at Rotterdam on the North Sea, it washes the borders or heartlands of six Western European countries: Switzerland, Liechtenstein, Austria, West Germany, France, and the Netherlands (map, page 454).

Yet the reach of the Rhine extends far beyond its banks. Through connections with scores of major rivers and canals, it forms the central artery in a vast circulatory system — the inland waterways of Europe. A Rhine River captain at Rotterdam, for example, can chart a fresh-water voyage not only to the great industrial ports of Germany's Ruhr, but also to Berlin, Paris, and even Marseille on the Mediterranean.* In another ten years, with completion of the Main River-Danube Canal, the list will include Vienna, Belgrade, and the Black Sea.

As a result, the Rhine is the world's busiest river. Its thousands of deep-bellied ships haul some 220,000,000 tons of cargo a year — a figure nearly equal to the combined total of those two North American giants, the Mississippi River and the St. Lawrence Seaway.

* Irving and Electa Johnson told of cruising "Inside Europe Aboard *Yankee*" in the August, 1964, GEOGRAPHIC, and David S. Boyer sailed from "Paris to Antwerp With the Water Gypsies" in the October, 1955, issue.

Golden gift of the Rhine refreshes West Germany's wine queen at a festival in Mainz. Each October the river rings with *Weinfesten*, celebrations proclaiming the harvest of Riesling and Sylvaner grapes.

"Music for the eyes and a melody for the heart." Thus English author John Ruskin spoke for generations of poets and artists inspired by the Rhine's haunting legends and romantic landscapes. Spanning the heart of Western Europe, the world's busiest river flows 820 miles and links six countries. Caesar, Attila, Charlemagne, Napoleon, and modern armies have fought for its strategic shores. Today, low-slung freighters ply a peaceful river, here threading narrows below a battlemented 14th-century watch-tower and sun-warmed vineyards at Oberwesel, Germany. Schönburg Castle crowns the hill at far right.

Statistics, however, merely skim the surface of the Rhine; it is a river fathoms deep in legendand history. Down the centuries those who have ruled — or stormed — its banks include Romans, Celts, Huns, Russians, Swedes, Hungarians, and Danes. During this century the list has lengthened tragically, in the course of two world wars. Little wonder that to Victor Hugo, the great French novelist and poet, the Rhine was "a stream that remembers."

My own memory of the Rhine begins at Rotterdam, that vast switching yard between a river and a sea. Rhine cargo today moves upriver in greater volume than down — among other things, as raw material for Germany's Ruhr — and I decided to follow the same route.

Valiant City Rebuilds Its Heart

Rotterdam, in a sense, is the front door of the Rhine and its tradesmen's entrance as well. The tradesmen are the merchant fleets of the world, which call at Rotterdam on the average of one ship every 19 minutes. Few get the chance to make Rotterdam's acquaintance. With a speed and skill born of centuries in sea trade, Rotterdammers empty their visitors' cavernous holds, transfer the contents to waiting Rhine ships, refill the holds with export cargo, and bid all hands a brisk but cordial "*Tot ziens* — Until next time."

The luckier landsman sees other faces of Rotterdam, including a 642-acre monument to Dutch spirit. The monument, Rotterdam's graceful new downtown district, replaces a grim casualty of World War II. On the afternoon of May 14, 1940, German bombers launched a savage terror raid on the historic heart of the city, hammering 30,000 buildings into rubble and taking some 900 lives.

Far from terrorized, Rotterdam weathered the blow and endured five years of wartime occupation. Freed in 1945, the city literally picked up the pieces; the rebuilt downtown area and port contain an estimated 52,500,000 reclaimed bricks.*

One April morning I toured Rotterdam's waterfront area by launch with Frank Gips, a friend and one of the managers of N. V. Cornelis Swarttouw, a prominent stevedoring firm.

Light rain blurred the skyline as we steered through the New Waterway — Rotterdam's channel to the North Sea, as well as the largest of the Rhine's five outlets. I remarked to Frank that during a week in his country I had not seen the sun once.

"Sometimes you have to look fast to catch it", he admitted. "In Rotterdam we have a saying, 'It's a good year when summer comes on a weekend.'"

Summer or winter, rain or shine, Rotterdam's pace rarely slackens. Frank guided me through half a dozen enormous basins,

* Helen Hill Miller told the dramatic story of "Rotterdam — Reborn From Ruins" in the October, 1960, GEOGRAPHIC.

or “havens”, dredged on either side of the main channel for berthing the port’s giant visitors. Ship sterns read like entries in a gazetteer — Shanghai, Liverpool, Karachi, Boston, Port Sudan, Leningrad, Bilbao.

Towering above the forest of masts and funnels, heavy dockside cranes unloaded the ships, endlessly swiveling, nodding, and bowing in a ponderous minuet. Little if any cargo touched the wharves; as each bulging net or sling rose from a hold, it went directly into a Rhine ship waiting alongside.

“We can’t afford to store cargo”, Frank explained. “Rotterdam handles 122,000,000 tons a year — roughly four tons every second, night and day. If we tried to store it all, we wouldn’t have any harbor space left. Our job is to get it out of one ship and into another — or into a truck or boxcar — and on its way.

“We think we do a pretty good job, and apparently other people think so, too. You know, they call the Dutch ‘the carriers of Europe’. Come and have a look at how we carry things on the Rhine.”

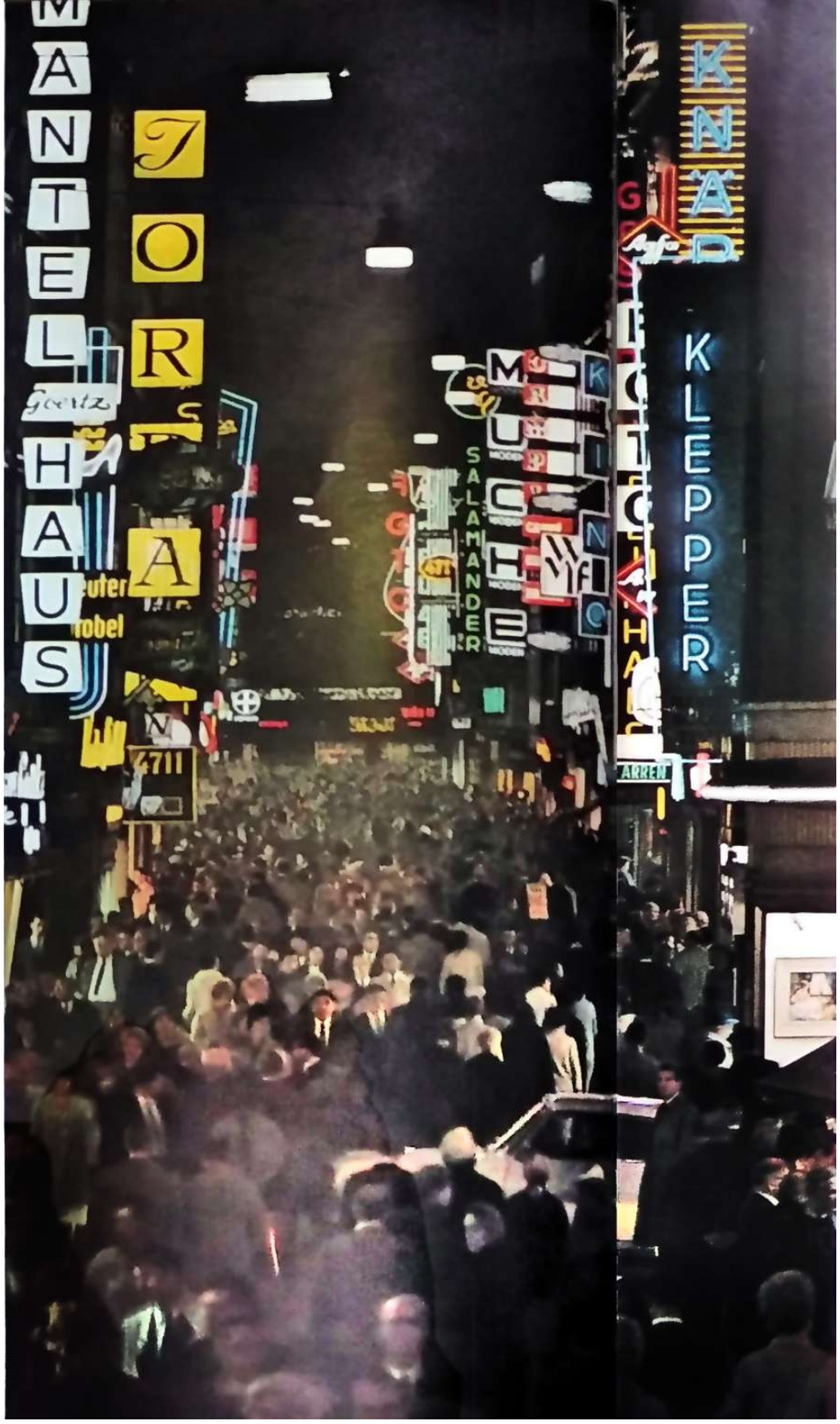
We drew alongside a somewhat smaller ship that at first glance seemed in dire straits. Blunt-nosed, sway-backed, decks nearly awash, it gave the impression of having been rammed both bow-on and amidships, with the wisest course for all hands to abandon ship. Frank read my thoughts.

“Don’t let her fool you,” he said. “Rhine ships come that way, long and low in the water when they’re loaded. Long, because they can’t be too wide — lots of narrow channels and locks to squeeze through; low, because they can afford it — no heavy seas to worry about on the Rhine.

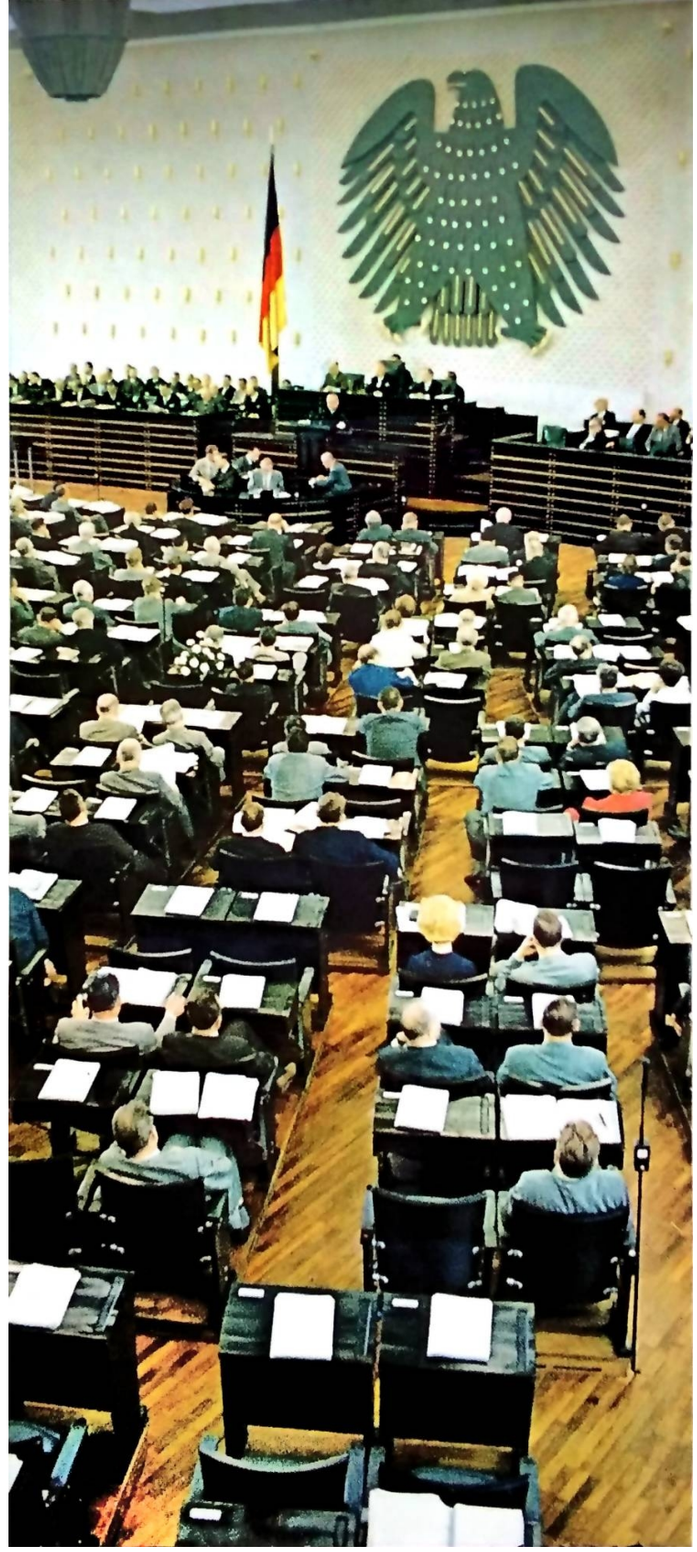
“Ugly? Maybe to a landsman. But don’t let a Rhineman hear you say it; you might just as well insult one of his family. Often, by the way, they live on board with him. Now, let’s have a look at the rest of Rotterdam.”

The rest of Rotterdam would have taken a full year, but Frank chose a good cross section. As we steered down-channel toward the North Sea, we passed the sturdy conning-tower shape of Euromast, the city’s 392-foot-high sightseeing spire. Just beyondlay Delfshaven, the small docking basin from which in 1620 — “the wind being faire”, according to one chronicler — a contingent of 46 Pilgrims set sail for England, where they joined their fellow voyagers aboard the *Mayflower*, bound for America.

Monument to prosperity and headquarters of a steel company, Thyssen House raises a wall of windows over Düsseldorf, unofficial capital of Germany’s industrial heartland, the Ruhr. Rebuilt from the devastation of World War II, the Ruhr powered the *Wirtschaftswunder*, West Germany’s “economic miracle” of recovery.



Neon canyon along Hohe Strasse in downtown Cologne lures a flood tide of evening shoppers, all but marooning a hapless motorist. Signs advertise products ranging from cameras to toilet water, demonstrating the diversity of West German industry.



Forum of democracy, the 496-member Bundestag, or lower house of parliament for the Federal Republic of Germany, meets at Bonn, West Germany's capital.

Dodging a near traffic jam of ocean-going freighters, Rhine ships, and tugs, Frank made a quick tour of Europoort, Rotterdam's vast unfinished bulk-cargo terminal. Miles of proposed docks may one day double Rotterdam's cargo capacity and put her ahead of rival New York for the title of world's largest port.

Finally we reached the Hook of Holland, a bleak point of land whose breakwater and solitary harbor warning light mark the Rhine's frontier with the North Sea (page 490).

It was a restless frontier. Beyond the dark edge of the river's flow, surf sweeping in across miles of empty ocean churned and lashed at its powerful opponent from the land. The ageless struggle recalled a declaration written centuries ago by the Frisians, early settlers along the lower Rhine and the builders of Holland's first dike system:

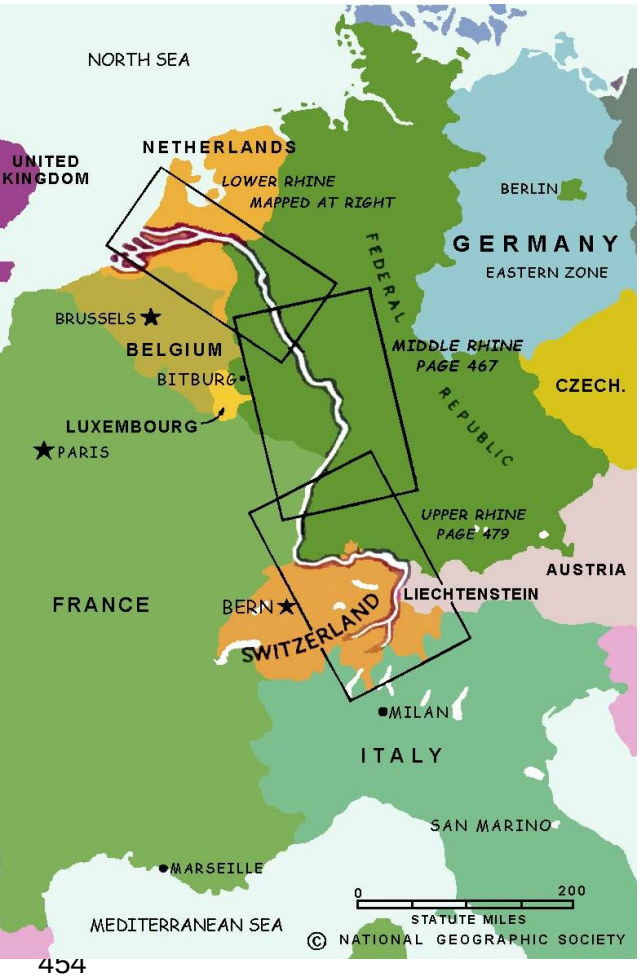
That we Frisians shall establish and control a sea fortress… against which the salt sea shall thrust by day and by night.

Frank swung the wheel, and we turned back upriver into the shelter of the fortress land. Ahead in the early dusk the lights of Rotterdam began to wink on. Beyond them lay the world of the Rhine.

Ship's Bell Sounds Rhineman's Prayer

Next morning I went in search of an empty berth aboard a Rhine ship bound upriver. I found one aboard *Weissenstein*, a newly built Rhine tanker sailing for Karlsruhe, Germany, with a cargo of diesel oil from Latvia. Her name was German, meaning "white stone", though her owner and crew were Dutch. I was soon to learn that among a dozen or more nationalities plying the Rhine, German is the riverman's tongue.

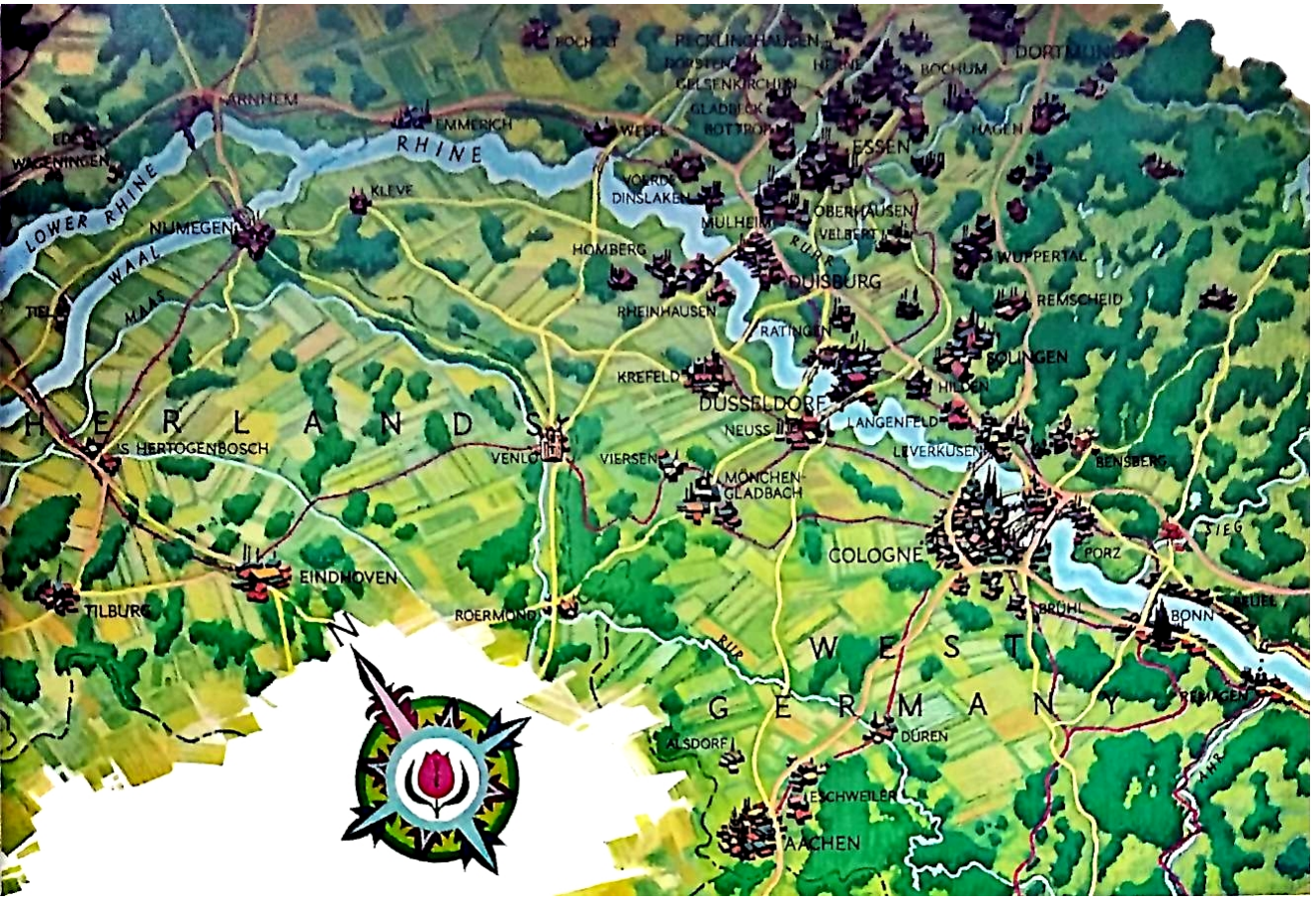
Weissenstein's captain, 42-year-old Hendrik Elbers, wasted no time. As I joined him in the wheelhouse, he gave three strokes on the ship's bell, an old Rhine custom signifying the riverman's prayer: "In God's name, a good voyage". The crew cast off lines and we edged away from the wharf, joining the long file of ships headed upriver.



Delicatessen afloat in Rotterdam Harbor provisions a Rhine captain, his wife, and the ship's mascot. Waterborne merchants do a land-office business among river families too pressed for time to shop on shore.

Father Rhine's long journey unfolds in three illustrated maps that divide the river into roughly equal sections (below, left). Cartographers exaggerated the river's width to show bridges and other details.

The first map (below) charts the lower Rhine, a vast delta with fingers outstretched across the Netherlands to the North Sea. At the tips of the fingers lie the great Dutch ports of Amsterdam and Rotterdam-Europoort. Traffic shuttles between these cities and the German Ruhr with most of the Rhine's cargo, which totals 220,000,000 tons a year.



Fast by Rhine ship standards, *Weissenstein* normally cruises at 15 knots. As downstream traffic swept by and we overhauled other ships laboring against the four-knot current, I borrowed a pair of binoculars.

The cargoes were staggering — in both size and variety. Downstream traffic tended to carry manufactured goods: new Volkswagens, tractors and farm machinery, steel pipe, diesel engines, giant rolls of newsprint. Upriver went oil, miniature mountain ranges of coal, iron ore, chemicals, scrap metal.

Now and then a colorful cargo broke the pattern. One downstream load consisted of a herd of cows, munching hay and good-naturedly mooing at passers-by. Here and there I caught sight of equally contented passengers — children safely penned in miniature playgrounds on deck.

Mixed Traffic Crowds River Highway

The ships themselves were as varied as their cargoes. There were aging matrons of the river, recalling the legend that “a Rhine ship never dies”, struggling upcurrent beside sleek new tankers and ore carriers. Others — the great motorless Rhine barges and powered ships too heavily loaded to make it alone — followed straining tugs on multiple tows often extending more than a mile.

Still other barges rode lashed to the bows of huge pusher tugs, newcomers on the Rhine. The original pusher design was tested in the Netherlands Ship Model Basin at Wageningen, for Mississippi River work, and later adopted widely in Europe.

Best of all were the ships’ names; many revealed their owners’ sentiment or keen wit.

Like a pod of lumbering whales, heavily burdened Rhine ships struggle upriver past the German city of Duisburg, Western Europe’s largest inland port. The thousands of commercial ships plying the river usually hold to the starboard side of the channel, but

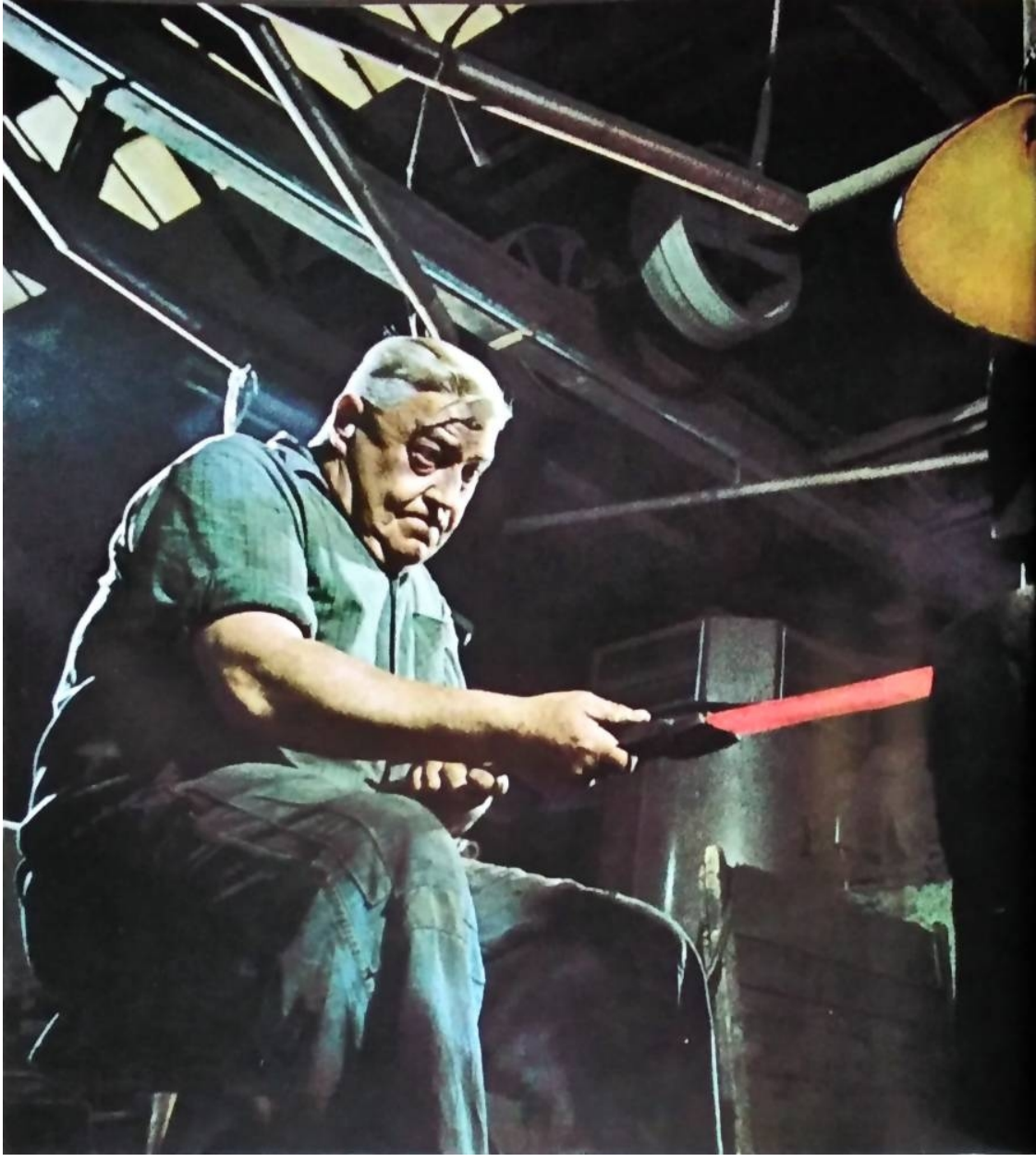
There were names of women, flowers, operas, explorers, saints, and even wines. My favorites were three in French belonging to a trio of ships that had obviously seen better days. As they limped around a bend, I trained the binoculars on their bows. The first was named *Vitesse* (Speed); the second, *Repos Ailleurs* (Rest Somewhere Else); and the third, *Risquons* (Let's Risk It).

To the Dutch, it seems, there is no such thing as one Rhine; it crosses their country under a number of aliases — Waal, Maas, Lek, Merwede, Old Rhine, Crooked Rhine, Lower Rhine, and a man-made addition, the Amsterdam-Rhine Canal (see the map of the lower Rhine, pages 454-5). As *Weissenstein* pushed eastward toward the German border, Captain Elbers explained that we were actually on the Old Maas — in French, the Meuse.

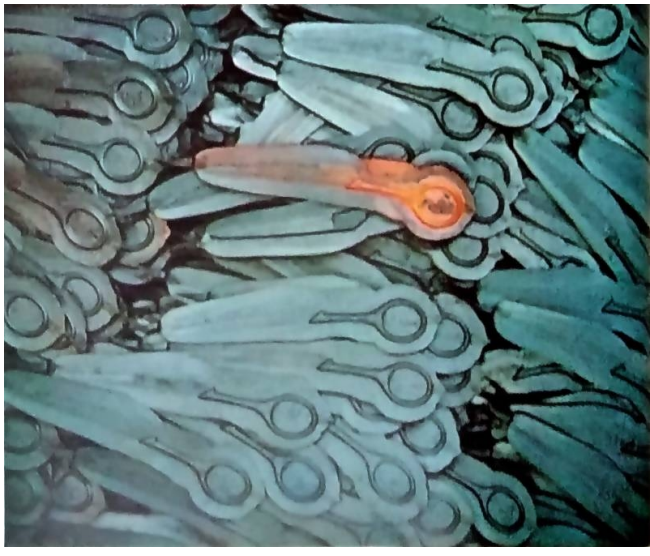
"The Rhine", he said, "is like a hand with fingers spread across the west of Holland. At the moment, we are on the middle finger, but soon others will join up. When we reach Germany, all the fingers will have drawn together in a single arm — the Rhine."

Some of the Rhine's fingers were brilliantly jeweled, for it was the height of the tulip season. Patches of bright color bordered the dark rivers like dazzling flotsam thrown up and left by a flood. The flowers themselves were largely by-products; many growers simply scythed them and spread them across the fields to help fertilize the precious bulbs beneath. Other growers found a happier use: I noticed several cars parked beside the river, their hoods all but buried under decorative garlands, giving them an air of race horses in the winner's circle.

rules permit upriver vessels to switch sides in search of weaker current. Downstream traffic must yield right of way. Cargo craft moor or anchor for the night, unless equipped with radar. Fog, a heavy freeze, or extreme low water brings shipping to a halt.



Vulcan of the Ruhr, veteran smith Heinrich Ashauer forges a cook's knife with a giant mechanical hammer at the Wüsthof works in Solingen. Despite the march of automation, German industry still relies on skilled craftsmen for many of its world-famous products, including optical instruments, cameras, and fine cutlery. After 42 years at his ear-splitting job, Herr Ashauer views the prospect of retirement warily; he fears the silence would make him nervous.



Glowing dagger, half of a scissors joins the cooling pile at Wüsthof. Such small items of cutlery, stamped out by automatic machines, are finished and assembled by hand.

We stopped overnight near the Dutch cities of Nijmegen and Arnhem, famous as targets — and in tragic thousands of cases, as the gravesites — of British and American air-borne troops in World War II.

As we ran mooring lines ashore, Captain Elbers explained that, if necessary, *Weissenstein* could navigate at night by radar. Like most Rhine ships, however, she generally lay up at sunset and got under way again at dawn.

"Dawn", I discovered, is a relative term. At sunrise I awoke to find our overnight mooring far behind and *Weissenstein* approaching the German frontier. As I joined Captain Elbers somewhat guiltily in the wheelhouse, he chided me with a sidelong glance:

"*Nee, nee*, you aren't a good Rhineman yet."

At the border town of Emmerich we cleared German customs without inspection and continued upriver. I was about to ask Captain Elbers a question about smuggling on the Rhine, when a launch flying the German customs service ensign streaked downriver toward us. Hesitating for a moment among a dozen ships, the helmsman abruptly made his choice and brought the launch alongside *Weissenstein*. Two purposeful-looking inspectors began clambering over our rail, and I was suddenly glad I had resisted wholesale bargains in Dutch cigars at Rotterdam.

The spot check was swift, courteous, and unproductive. The German crew waved from the launch and was gone. *Weissenstein* regained speed and continued south through the rolling German countryside, soon to change dramatically.

Iron Rhine Washes the Coal Bucket

Nothing prepares a passenger on the Rhine for his first view of Germany's industrial heart, the Ruhr. At a turn in the river it simply erupts from the green landscape like a volcanic island thrust from the sea. The towering shapes of blast furnaces and smoke-blackened chimneys give the impression of so many giant cinder cones.

To Germans, their 120-square-mile industrial colossus is the *Kohlenpott*, or Coal Bucket, and the section of river beside it is *der eiserne Rhein* — the Iron Rhine. The nicknames are well-earned, for the Ruhr produces most of West Germany's industrial coal and 75 per-cent of her iron and steel. Until recently it also produced something less desirable — contamination of the Rhine. Under new controls, both the Ruhr River and the Rhine have begun the battle against pollution.

Near Duisburg, the Ruhr's major outlet on the Rhine and Western Europe's largest in-land port, I said goodbye to *Weissenstein*. Captain Elbers steered her smoothly alongside a quay, maintaining slight headway as I jumped ashore. "*Tot ziens* — Until next time!" He waved from the bridge, and *Weissenstein* was swallowed up in the river's traffic.

On maps the Ruhr appears as a cluster of great cities — Essen, Dortmund, Mülheim, Duisburg — surrounded by smaller satellites. The divisions are more technical than real; the Ruhr is one vast continuous factory, forever wrapped in the dark cloud of its own breath. Night transforms the Ruhr into a gigantic blowtorch, searing both the sky above and, by reflection, the Rhine below.

Residents joke grimly that "only in the Ruhr does snow turn black before it reaches the ground."

Twice in this century the Ruhr has blackened its own name by becoming the forge of war. The distinction cost cruelly. By 1945, the price to Essen alone had reached 6,500 air-raid dead and 20,000,000 cubic yards of rubble.

Rebuilt in postwar years, the Ruhr turned to a peaceful crusade — West Germany's *Wirtschaftswunder*, or "economic miracle" of recovery.* Recovery blossomed into record prosperity, especially for the Ruhr.

The region's prodigious talent and energy reach far beyond West Germany's borders. In Duisburg I visited DEMAG, one of the world's largest makers of heavy machinery. With Manfred Piwinger, a young company representative, I toured hangar-size plants where DEMAG turns out powerful tunneling machines for coring through solid rock, 375-ton floating cranes, complete iron and steel plants, and rolling mills for shipment abroad. Finally, we inspected an experimental project for fueling nuclear reactors.

"That is for the future", Mr. Piwinger said, waving at the project, "but our work also deals with the past. DEMAG machines recently helped save ancient Egyptian monuments from flooding at Aswan Dam on the Nile."†

Craftsmanship Still Has a Place

For all its miracle of size and automation, the Ruhr still relies on the skilled craftsman. No one, for example, has invented a machine to take the place of Heinrich Ashauer.

I met Herr Ashauer in the Ruhr town of Solingen, a name world-famous for fine steelware. I had called at Wüsthof, a Solingen firm that manufactures everything from giant cleavers to fragile shears for slicing the tops off boiled eggs.

A Wüsthof guide led me past the assembly lines, where workers at batteries of intricate machines produce 3,000 different items of cutlery. Finally we came to a small shed adjoining the main factory.

The sound from the shed was appalling, like that of a pile driver at point-blank range. Inside amid the gloom I found Mr. Ashauer, a white-haired figure bent over a glowing forge beside the largest hammer I have ever seen (page 458).

The head of the hammer had the heft of a wrecking ball, and the arm was a great wooden beam. Massive gears at the base of the arm lifted the whole apparatus at the rate of twice a second and brought it down on a giant anvil. With huge tongs Mr. Ashauer snatched slabs of glowing steel from the forge and held them at varying angles under the hammer. It seemed a technique out of a vanished age, an astonishing sight in today's Ruhr.

Silence Upsets Veteran Smith

Fascinated, I motioned politely toward the door. Mr. Ashauer removed two small cotton ear plugs and followed me outside some distance from the shed. Finally we could talk, and I asked what he was making. It developed that the slabs of glowing steel were Wüsthof's largest and finest chefs' knives.

"They cannot be made like other knives, in the automatic machines", Mr. Ashauer explained with quiet pride. "Because of the size and type of blade, each piece heats slightly differently in the forge and must be very carefully tapered". He pointed toward the assembly line. "Machines can heat and shape well enough, but the best steel still comes from a man's hand."

As the hammer thundered away, I asked Mr. Ashauer how long he had been making knives. "Forty-two years", he replied.

Didn't the sound ever bother him? He shook his head.

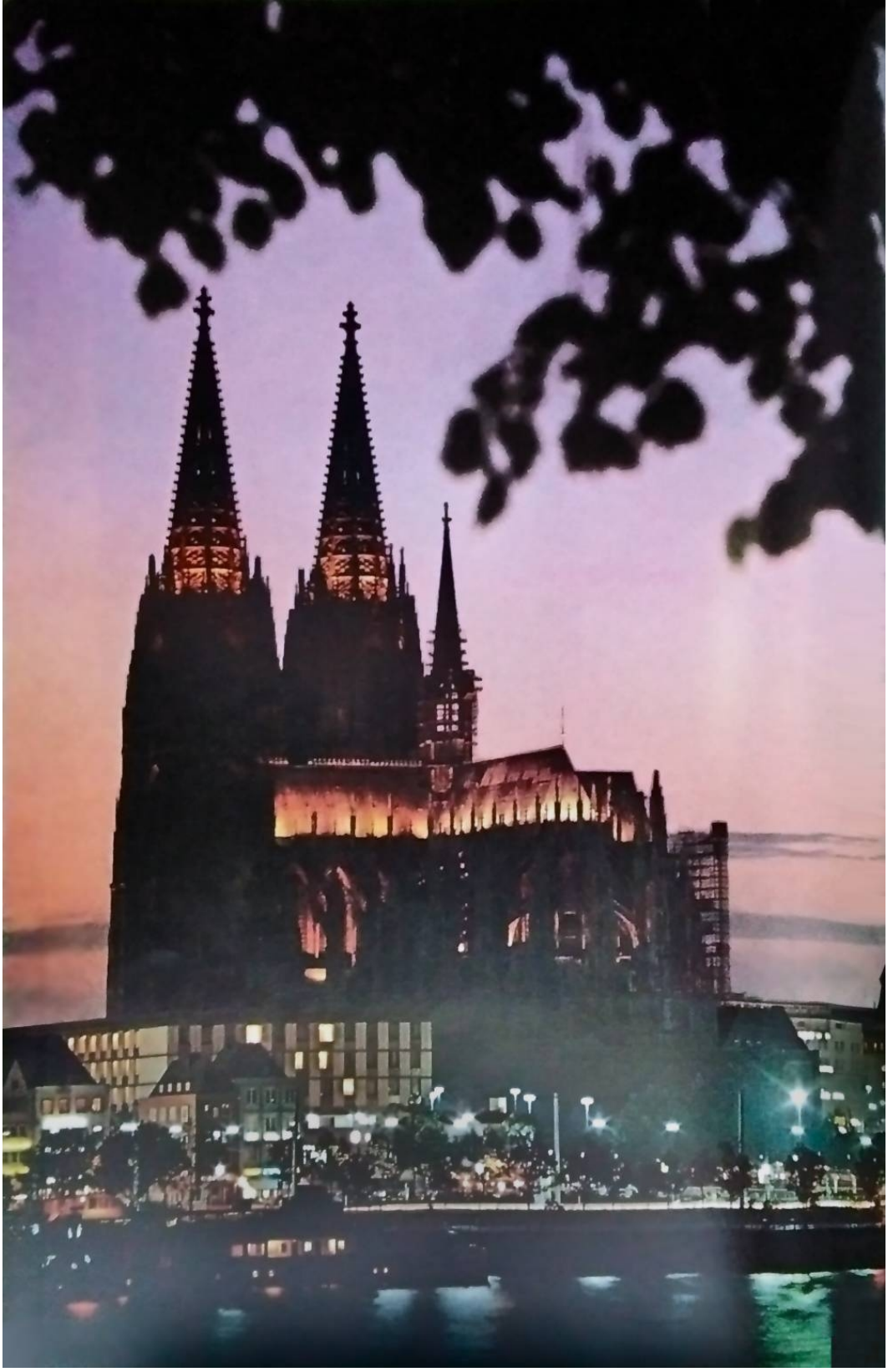
"We've grown used to each other, the hammer and I. To me, it is like the sound of my own breathing. I do not believe I could ever retire — the silence would make me nervous."

Not long afterward I saw one of Mr. Ashauer's knives in a gleaming cutlery show window in Cologne. The Rhine's largest city, with a population of 862,000, Cologne is famous for its independence and outspoken wit. In the dark days of 1945, when the city lay a honeycomb of ruin, an anonymous resident posted a sardonic sign amid the rubble. It quoted a speech by Adolf Hitler during his catastrophic rise to power:

GIVE ME FIVE YEARS AND YOU WILL
NOT RECOGNIZE GERMANY AGAIN

* See "Modern Miracle, Made in Germany", by Robert Leslie Conly, NATIONAL GEOGRAPHIC, June, 1959.

† Georg Gerster described "Saving the Ancient Temples at Abu Simbel" in the May, 1966, GEOGRAPHIC.



Anthem in stone, Cologne Cathedral rises in floodlit splendor beside the Rhine. Begun in 1248 and not completed until 1880, the Gothic masterpiece again wears an apron of scaffolding on its lower tower and flying buttresses; masons repair war damage and replace stones crumbled by erosion. Allied bombardiers managed to spare the great church from extensive damage when they devastated the German city in World War II.

Built above rubble, houses along the city's riverfront recapture the mood of 18th-century Cologne. Postwar planners followed the lead of United States communities like Philadelphia, reconstructing everyday homes and declaring them historic monuments. Curator of the project — which houses tenants under strict rules protecting the buildings — is a native daughter of Cologne, Dr. Hanna Adenauer. Her famous uncle, Dr. Konrad Adenauer, former Chancellor of the Federal Republic of Germany, served as Lord Mayor of Cologne following World War I. Hitler removed him from office in 1933 as an enemy of Nazism.

Window on *Wunderland* beguiles a young Rhinelander in downtown Düsseldorf. *Spielwaren* — toys — contribute heavily to West Germany's foreign-trade balance. Manufacturers specialize in mechanical toys but avoid items reminiscent of war.

Adolf Hitler, for one, would not recognize postwar Cologne; it is prosperous, gay, and inviting (pages 453, 461, and above). Moreover, it has lost none of its gift for humor, as I discovered one evening when I visited a small *Stube*, or cafe.

Ordinarily, visitors in the Rhineland are encouraged to sample the region's superb wines, but the stube played no favorites. As I hesitated over the wine list, the waitress, an ample and beaming Rhinelander, waved a rosy arm at a sign pasted above the doorway. Mixing Latin and German in verse, it proclaimed: "*In Vino Veritas; in Bier ist auch etwas*" — roughly, "In Wine There Is Truth; in Beer There Is Also a Little Something."

Cologne's most famous and perhaps most independent son, West Germany's postwar Chancellor, Dr. Konrad Adenauer, was once the city's Lord Mayor. A fierce opponent of Adolf Hitler, "*der Alte* — the Old One", as West Germans affectionately know him,

spent part of World War II in Gestapo custody, but escaped execution. The war in its last stages very nearly accomplished what the Gestapo did not: Der Alte narrowly avoided a direct hit by an artillery shell in his garden at Rhöndorf beside the Rhine.

"About 300 yards away, I saw a shell hurtling toward me", he calmly describes the incident in his memoirs. "I could gauge distances fairly well, because I knew the area intimately". The knowledge — and a quick dive — saved Adenauer's life, as well as the possible future of free Germany.

West Germany's impressive rise under Konrad Adenauer transformed a quiet Rhineland community, Bonn, into a world capital. The official seat of the Bundesrepublik, the German Federal Republic, lies 20 miles up-river from Cologne. Once noted chiefly for its university and as the birthplace of Beethoven, Bonn now holds a proud place among the political centers of the world.

Adenauer Busy as Lawmaker at 91

At the Bundestag, the 496-member lower house of parliament, I applied for a visitor's pass. The guide, an attractive young girl, led me upstairs to a seat overlooking the chamber (page 497). Dr. Adenauer — still an active member of the Bundestag at 91 years — was absent that day, but the voting and debate were brisk. The question before the house was the federal budget, particularly the military appropriations bill. From the speeches one could gather that the bill would pass, but that many had strong reservations.

As my young guide led me back to the main entrance, we fell to discussing the bill and German defense. I remarked that although members of her generation were too young to have known war, they seemed to share many older Germans' horror of it.

"It is true we did not see the last war", she said, "or even much of the wreckage — the wreckage disappeared after a while. But there are other marks on our country not so easy to hide, like that sign over there." She pointed to a small notice in German beside a parking lot. It read: "Reserved for Severely Disabled Members of the Bundestag."

"That is the worst kind of wreckage."

Ruin Recalls War's Final Chapter

One mark of war, little visited today, links Americans forever with the Rhine. Beside the river south of Bonn stand three massive stone towers amid a jumble of masonry — all that remains of the bridge at Remagen.

On the morning of March 7, 1945, units of the American First Army, seeking a break in Rhine defenses, found the bridge intact. German engineers, with grim efficiency, had blown all other heavy spans across the river; Remagen's turn was to come at four o'clock that afternoon. But Remagen's turn never came.

Minutes before deadline, American infantry and engineers raced across the bridge under fire and cut the electric cables leading to the demolition charges. The bridge, an old one, held up long enough for armor and more infantry to cross. Ten days later it collapsed, never to be rebuilt. The break-through at Remagen smashed a gap in Hitler's West Wall and hastened the final chapter of the war.

It was a chapter both fearful and comic for Hans Fassbender, who was 12 years old at the time of Remagen. Fearful for Hans because he happened to be riding his bicycle past the German end of the bridge during the opening phase of the assault; comic, in his later encounter with American troops. I heard the story from him one day near Remagen with a group of American friends.

Hans's mother had sent him from their village of Kasbach, several miles east of the Rhine, to fetch his aunt, who lived near the Remagen bridge. U. S. troops were reported closing on the river from the west, and Frau Fassbender feared for her sister's safety.

"I got to my aunt's house", Hans explained, "and she was feeding some Volkssturm — homeguard soldiers, mostly old men and teen-aged boys. She told me she would come as soon as she was finished."

When Hans reached the bridge on the return trip, he was struck by the uneasy silence.

"I knew there were German troops around", he said, "because I had seen them only a short time before, working near the bridge. Now there was nothing — only some wrecked 37-millimeter guns, with abandoned rifles slung on their barrels."

The Germans, in fact, had taken cover in a nearby tunnel to talk over blowing up the bridge. Suddenly from across the river, American machine guns and small arms opened fire.

"I could hear the crackle, like a typewriter", Hans explained, "and for a moment I guess I just stopped, listening. Then twigs and leaves started dropping from the trees, and I said to myself, 'Hans, it isn't autumn.' I must have set a speed record pedaling home."

The Americans didn't reach Hans's village for several days, but well before that, he knew the war was lost.

"Some Panzers, German tanks, came through the village one morning", he said, "and one of them started sputtering and finally stopped. The tank commander asked us for gas, but we didn't have any. He found a blow-torch lying around and he drained that into the tank — it hardly got him beyond the village."

When the Americans arrived, they stayed several weeks, and Hans found them gruff but friendly. Several moved in with the Fassbender family and insisted on sharing their C rations. The one thing the Americans did not have was fresh food — and Frau Fassbender kept a flock of geese.

"The Americans were very polite", Hans said. "They never took any geese. But my mother woke me every morning at four, because it was anybody's race to get the eggs."

I arrived in Koblenz, at the junction of the Rhine River and the Moselle (in German, the Mosel), simultaneously with three venerable saints — Mamertus, Pancratius, and Servatius.

Romance and the river meet on the middle Rhine, beloved for its scenic treasures and aura of legend. Focus of both, the castled Rhine Gorge — sometimes called the *Gebirgsstrecke*, or "mountain stretch" — winds 35 miles between Koblenz and Bingen. Other landmarks record modern history. At Remagen and Oppenheim, United States troops in 1945 breached Hitler's West Wall, foreshadowing the fall of the Third Reich.

Middle Rhine
0
25
STATUTE MILES
COLOGNE
BRÜHL
PORZ
SIEGBURG
BONN
BEUEL
SIEG
BAD GODESBERG
RHÖNDORF
NONNEF
REMAGEN
KASBACH
SINZIG
AHR
RHINE
NEUWIED
ANDERNACH
MAYEN
KOBLENZ
OBERLAHNSTEIN
DIEZ
LIMBURG
LAHN
WETZLAR
GIESSEN
MOSEL
KRAUBACH
MARKSBURG
BOPPARD
COCHEM
WEST GERMANY
ST. GOARSHAUSEN
MOUSE CASTLE
CAT CASTLE
LORELEI
KAUB (GUTENFELS CASTLE)
ZELL
OBERWESEL
THE PFALZ
BACHARACH
SOONECK CASTLE
REICHENSTEIN CASTLE
BINGER LOCH
RÜDESHEIM
WIESBADEN
FRANKFURT AM MAIN
PIESPORT
BERNKASTEL
SINGERBRÜCK
MÄUSETURM
RHEINGAU
HOFHEIM
MAINZ
MAIN
OFFENBACH
TRIER
BINGEN
NIERSTEIN
BAD KREUZNACH
OPPENHEIM
NAHE
ASCHAFFENBURG
DARMSTADT
BENSHEIM
LORSCH
WORMS
MICHELSTADT
MILTENBERG
FRANKENTHAL
MANNHEIM
BAD DÜRKHEIM
LUDWIGSHAFEN
LADENBURG
KAISERSLAUTERN
NEUSTADT
HIRSCHHORN
SCHWETZINGEN
SPEYER
HEIDELBERG
PIRMASENS
LANDAU
WALLDORF
SINSHEIM
WISSEMBOURG
BRUCHSAL
BAD WIMPFEN
KARLSRUHE
GRÖTZINGEN
ETTLINGEN
HAGUENAU
BIETIGHEIM
RASTATT
PFORZHEIM
FRANCE
GERNSBACH
BADEN-BADEN
STUTTGART
ESSLINGEN
STRASBOURG
OBERNAI
BLACK FOREST
(SCHWARZ WALD)
CALW
ALTENSTEIG
BÖBLINGEN
OFFENBURG
N
PAINTED BY DAVIS MELTZER
COMPILED BY GEORGE W. BEATTY
GEOGRAPHIC ART DIVISION
© NATIONAL GEOGRAPHIC SOCIETY

Each spring the holy trio visits Germany's wine region and brings either a blessing or bad luck to the vineyards. Rhinelanders call them *die Eisheiligen* — the Ice Saints — and look forward with mixed feelings to the visit.

The Ice Saints arrive in spirit on May 11, 12, and 13, the individual feast days named for them in the church calendar. Tradition holds that the weather they bring with them — warm sunshine, or a sudden cold snap — foretells the size of the coming harvest in October.

Actually, there is more than mere superstition to the Ice Saints, for along the Rhine and its sister stream, the Moselle, early May is a critical time for the young grapevines. Sudden spring frost can destroy the weaker vines at a moment when it is too late to replace them. The stronger vines generally escape without damage, but the total harvest is reduced.

The working Rhine shows in three views near the Lorelei (right), the massive brow of rock where, in Teutonic legend, a beautiful siren lures rivermen to death. In a Fisheye-lens panorama, red and white flags at a control station warn captains bound upriver of downstream traffic. Below, straining tug helps the ponderous *Hungaria* past the same station at dusk. Fisherman relaxes after netting eels, perch, and river trout.

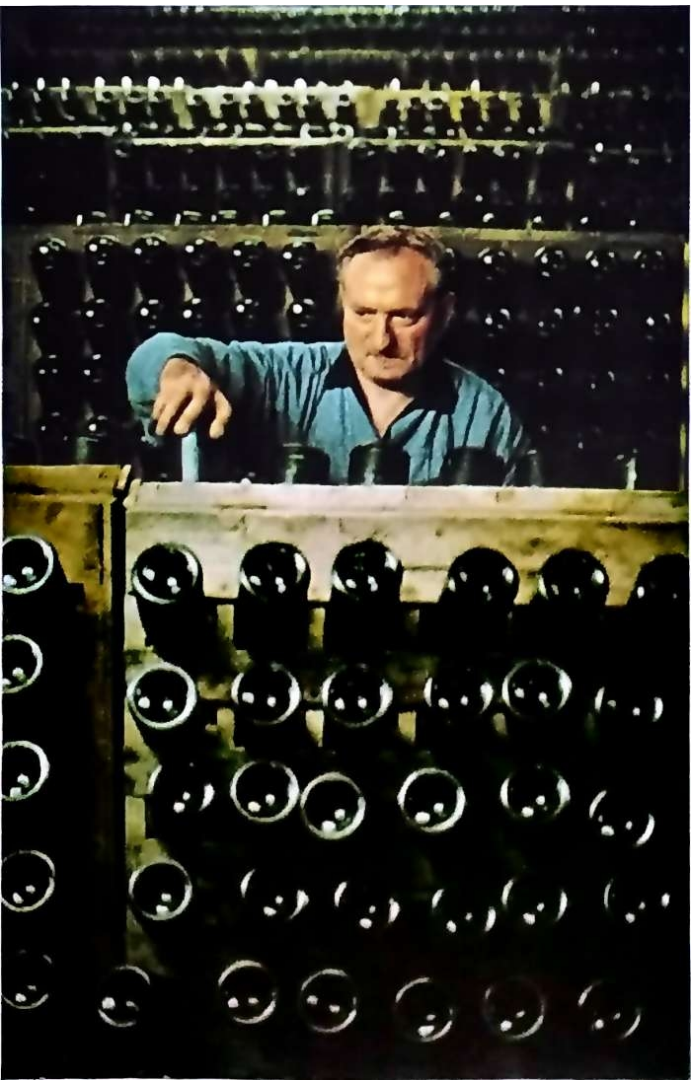
HUNGARIA ROTTERDAM

The Ice Saints' domain is as vast as it is colorful, taking in the entire German stretch of the Moselle and all the Rhine Valley, roughly between Bonn and Heidelberg (map, middle Rhine, page 465) — an area, astonishingly, in the same latitude as Newfoundland and parts of Labrador. Although warmer than its New World counterpart, the Rhineland lacks the strong sun necessary for the great red wines of France. As a result, the Moselle and Rhine wines are white, with few exceptions.

More than 2,000 towns and villages on the Rhine and Moselle grow wine grapes, though many of their names are unknown even to connoisseurs. Small vineyards often sell their harvests to larger wine centers — Bernkastel, Nierstein, Piesport, Rüdesheim — to be bottled under such world-famous labels.

Wading in Wine — and No Glasses

The Ice Saints were kind to Koblenz during my stay, bringing three days and nights of near-summer weather. The coolest spot in the city, in fact, was the cavernous cellar of Deinhard and Company, Koblenz's internationally famous wine firm. I toured the deep underground labyrinth with Johann Michaelis of the firm's export division.



Making room for more, a young girl at Oberwesel tamps down grapes with an old-fashioned mallet. Chalk marks on the barrel record the contents by basketfuls. Harvesttime empties schools and homes of all able-bodied workers in 2,000 communities along the Rhine and Moselle.

Skillful twist — once daily for each of thousands of bottles — shakes down excess yeast in *Sekt*, or sparkling wine, in a Koblenz winery. Experts will later remove residue from each bottle's mouth. Despite sekt's resemblance to its better-known French cousin, Germans respect the international agreement that forbids them use of the word champagne.

Mr. Michaelis led me through twilit chambers carved from solid rock, past ranks of huge casks holding as much as 7,000 gallons each, and through rooms where Deinhard stores roughly 2,000,000 bottles of wine (opposite). Finally it came time to sample some of the wealth. Mr. Michaelis selected several vintages each from the Rhine and the Moselle.

All were delicious, but I found the Rhine wines generally sweeter than the Moselles. Mr. Michaelis agreed.

"Many Rhine vineyards grow the Sylvaner and Traminer grape", he explained, "while the Moselle vines generally produce the drier Rieslings."

Deinhard and Company once inadvertently gave a *Weinfest*, or wine party, for 1,000 guests in its underground stronghold. During World War II, the cellar served as a bomb shelter for the harried people of Koblenz. One afternoon a heavy bomb demolished the Deinhard plant aboveground and jarred — but didn't injure — the people in the caves below.

"The shock opened the joints in some of the larger casks", Mr. Michaelis said, "and soon the floors of the cellar were running ankle-deep in wine — 25,000 gallons of it."

It sounded like a Rhinelander's dream come true, but Mr. Michaelis shook his head.

"Unhappily, the lights had gone out, and of course there were no glasses, so people couldn't drink the wine. But it didn't matter. The doors of the cellar were temporarily blocked, and I'm told that after breathing the fumes for five hours, everyone was feeling quite frisky."

Castles Still Stand Watch on Rhine

Other cellars along the Rhine are less hospitable, as for example the one at Marksburg. The grim fortress on a cliff overlooking the spectacular Rhine Gorge gives the impression that blood, rather than vintage Riesling, once ran in torrents upon its dungeon floor.

Blood, in fact, runs through the history of the Rhine Gorge almost as plentifully as the Rhine itself. Along the world-famous chasm through the Taunus Mountains, scarcely a castle or ruin — Marksburg, Gutenfels, Sooneck, Reichenstein — tells a happy or peaceful story. Even those with quaint names, such as the fortresses "Cat" (pages 492-3) and "Mouse", memorialize the Rhine's dark past.

Liebfraumilch in the making: A young Rhinelander gathers Sylvaner grapes near Schönburg Castle at Oberwesel. In most areas, wine-growers' councils set the starting date for harvest, closing the vineyards to everyone for days ahead of time to avoid premature picking. Growers sometimes risk leaving their grapes to ripen beyond regular harvesttime. If successful, the gamble on good weather produces a *Spätlese* — literally, "late vintage" — a wine of particular sweetness. Sweeter still is the *Eislese*, or highly prized "ice vintage", a wine from grapes left on the vine until partially frozen, then pressed to obtain juice only from the sugary centers.

Most of the castles date from feudal times, when the Rhine was a freebooter's paradise. Lacking a powerful emperor or king, Teutonic knights fortified the heights along the narrow gorge and set themselves up as independent rulers. For income between wars, they turned to the historic river trade, levying tolls on all ships that passed. Captains or owners unable to pay risked losing not only their cargoes but their lives — the latter, in some cases, slowly.

Militarism itself subdued the knights: Prussian supremacy and confederation of German states in the early 1800's put an end to despotism on the Rhine. The practice of tolls died in 1868 with the historic convention of Mannheim. Under the treaty, countries bordering the Rhine declared its waters free and unhindered to ships of all nations. Today the fortresses, once known to the poet Byron as "chiefless castles breathing stern farewells", breathe welcome instead as public museums, and in some cases even as restaurants, hotels, and youth hostels.

One despot remains in the Rhine Gorge to this day — the fierce, intractable river itself. From early Roman times of exploration and conquest along the Rhine, boatmen have feared the 35-mile-long *Gebirgsstrecke*, or "mountain stretch", as the gorge is sometimes known. Clamped between the mountains' massive jaws, the river twists and writhes in its narrow bed, forever creating new currents and shoals to trap the unwary helmsman.

For centuries Rhine ships have turned to special pilots to guide them through the mountain stretch. The 180 *Lotsen*, as the pilots are called, are divided into three groups, one working the northern half of the gorge, another the southern half, and a third group working both sections.

One day at Kaub, the midway point, I talked with one of the pilots on the northern run. I had traveled upriver from Koblenz aboard one of the fast and comfortable Rhine excursion boats, and I mentioned having seen the Lorelei, the mass of rock that towers 433 feet above the river (page 467).

Sidesaddle rider clutches her plunging mount at a fair in Mainz. Rhinelanders are famous among Germans for a spirit of gaiety. *Fasching*, a prolonged version of Mardi Gras, reaches its zenith in such Rhenish cities as Mainz and Cologne.

Dubious diner tastes a first mouthful of *Wurst*, or German sausage, as his companion awaits the verdict during a wine festival. Garlands of sausage form a spicy canopy over the booth.

What, I wondered, did a pilot think of the Rhine's best-known legend — of a beautiful siren who sits atop the rock and lures rivermen to their deaths in the treacherous narrows below? Or of the legend that the Lorelei watches over the Rheingold, the drowned treasure of the Nibelungs that indirectly cost the heroic Siegfried his life? Variations on the theme form the basis of Richard Wagner's group of four operas, *The Ring of the Nibelungs*.

Drowned Wealth Lies at Siren's Feet

"There may be a good reason for the Lorelei legends", my pilot friend observed. "The narrows there *are* treacherous; we call them *die Schere* — the Scissors — and they can do to a ship just what scissors do to thread. In the old days of witchcraft and superstition, if a captain made a mistake and lost his ship, who better to blame than some demon?

"As to the treasure, probably enough cargoes have gone down at the Lorelei to equal a thousand Rheingolds."

One of the great hazards to navigation in the Rhine Gorge is the river's habit of changing levels. At Kaub, generally regarded as the gauge for all river traffic, the Rhine can vary as much as

Floating on its reflections, historic Strasbourg spans a network of calm canals. Man-made waterways connect the Alsatian capital with France's vast river system, giving small Rhine ships access to such distant cities as Paris and Marseille. Watchtowers of the Ponts Couverts mark the line of the city's old defense wall. The single Gothic spire of famed Strasbourg Cathedral rises in the distance at right.

Bounty of the Rhine bursts with color in a Strasbourg grocery stand. Signs offer choice dark grapes for 18 cents a pound, beans for 24 cents, tomatoes for 8, and mushrooms at $1.09. Red paper band identifies inexpensive table grapes.

Raisin
cardinal
k.lo
CHASSELAS
Haricots
Beraquet
sans
k.lo
Tomates
k.lo
0,90
Girolles
250 gr.

22 feet between a spring high and an autumn low. Even a veteran sailor, Capt. Irving Johnson, whose ketch *Yankee* has roamed most of Europe's waterways, was once caught off guard.

"It happened just as we were mooring near Binger Loch at the southern end of the gorge", Captain Johnson told me one day aboard *Yankee*. "My wife Exy and I had been there only the week before, and *Yankee* had found clearance to spare. But in just those few days, the river had dropped nearly two feet, and we hung up fast on a ledge of rock.

"Of course, *Yankee* is built to take things like that in her stride, though I think Exy became a little nervous. I got one of the small Rhine ferries to run a line ashore for me, and then I took a strain on it with a winch.

"By that time", he added, smiling, "there were hundreds of people on shore, watching to see the crazy Americans founder. I'm afraid we disappointed them; the line ashore did the trick and *Yankee* slid off as smoothly as the day she was launched."

I remarked that even today in the dangerous Binger Loch, some Rhine captains' wives are said to hide the family valuables in a pocket or handbag, to be ready for a hasty departure.

"Exy's the perfect wife and sailor", said Captain Johnson. "The only things she hid were her feelings."

Three Minutes Away: a Grim Frontier

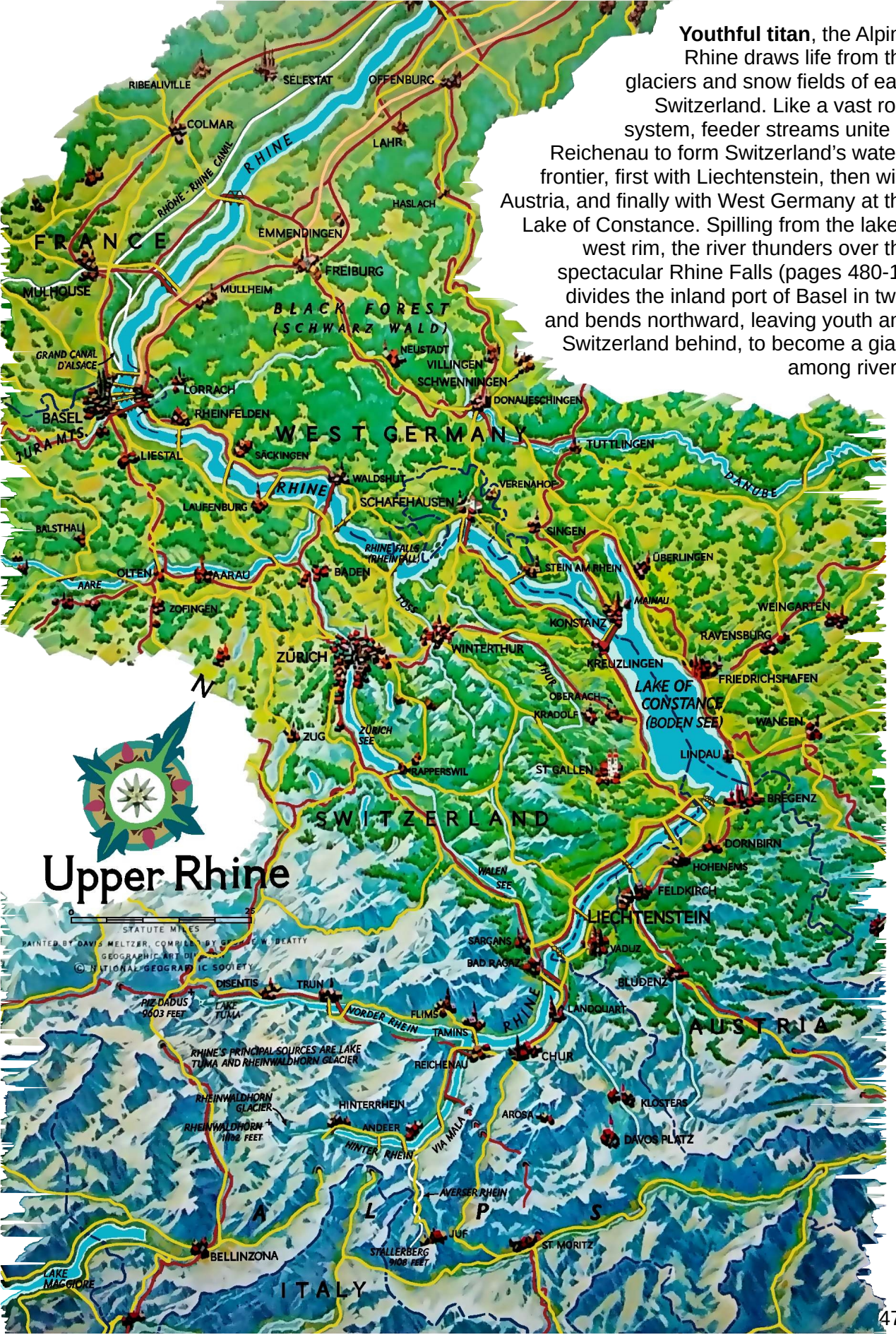
Near the city of Wiesbaden I got a broad view of the Rhine, from some 15,000 feet up. My guide was Capt. Joseph Schroeder of the United States Air Force's 525th Fighter-Interceptor Squadron, based at Bitburg, 50 miles west of the river.

To Joe Schroeder and his fellow pilots in the U. S. and West German Air Forces, the Rhine has sober significance: In an age of missiles and supersonic aircraft, it has become a virtual border with Communism. From the Rhine at Wiesbaden, U. S. jets can reach the so-called buffer zone on the East German frontier in less than three minutes (map, page 454). With Air Force permission, Joe gave me a carefully modified version of an interception across the Rhine.

Buckled beside him in a two-seat F-102 Delta Dagger, I repeated his instructions about ejecting from the plane in an emergency. I asked whether, if it came to trouble, I would interfere with him by ejecting first.

"Look", said Joe reassuringly, "don't worry about leaving me behind. If the pilot of a disabled jet says, 'Eject!' and you take time to say, 'What?' you're already talking to yourself."

"Something old, something new…" A wedding party near the Swiss town of Oberaach leaves the church in traditional style. Bound for the reception, bride and groom beam happily from their flower-decked two-horse carriage. Until recently, Swiss wedding couples favored such modern touches as bubble-top limousines, but local fashion has swung back to the graceful and leisurely open coach.



Youthful titan, the Alpine Rhine draws life from the glaciers and snow fields of east Switzerland. Like a vast root system, feeder streams unite at Reichenau to form Switzerland's watery frontier, first with Liechtenstein, then with Austria, and finally with West Germany at the Lake of Constance. Spilling from the lake's west rim, the river thunders over the spectacular Rhine Falls (pages 480-1), divides the inland port of Basel in two, and bends northward, leaving youth and Switzerland behind, to become a giant among rivers.

We climbed through the haze to sunlight at 15,000 feet and swung eastward toward the Rhine. Other American and West German jets were busy that day. High overhead I caught the occasional flash of contrails, like paper streamers unraveling across the sky.

The F-102 — especially the two-seat trainer — is no match for the latest interceptors, but neither is it any laggard. Joe edged our speed past 500 miles an hour, and we swept across the Rhine, a rivulet of molten pewter far below.

We had orders to steer clear of the buffer zone, but the demonstration was still impressive — within three minutes from the Rhine by my watch we were in sight of East Germany, a sun-flecked patch of uneven green half-hidden beneath the clouds ahead.

"We'll be on their radar by now", Joe said. "Another few minutes on this course and we'd have company up here. Company, that is, not friends."

He made a tight turn, letting down as we reached the river again.

As details below came into focus, I made out the long lines of tireless ships, each trailing its small white fork of a wake. Seeing them struggling against the current with their heavy loads, or riding easily down it, I remembered how one Rhine captain described them — “iron salmon”.

Joe turned again, following the river southward — and Rhine history unfolded below us.

International corner, the Swiss city of Basel lies at the meeting place of West Germany, France, and Switzerland. The Rhine’s highest major port, a world center of pharmaceutical research and manufacture, handles a fourth of all Swiss foreign commerce. This aerial view northward from Greater Basel includes Little Basel across the Rhine and the distant hills at Germany’s Black Forest. West of the Rhine, at upper left, stretch the plains of Alsatian France.

On our right lay Mainz, the birthplace five and a half centuries ago of a genius named Johann Gensfleisch, literally, “gooseflesh”. The world knows him better — for his pioneer use of movable metal type, and for a historic Bible — as Johann Gutenberg, the name he adopted from his mother’s family, which had no sons to preserve it.

Another unorthodox Rhinelander left his mark on Worms, to our right as we streaked up-river. There in 1521, before an imperial court, the Diet of Worms, a former monk named Martin Luther defied the powerful church of his day by condemning its sale of indulgences — the spark that set off the Reformation.

Joe brought me back to the present with a sweep over Mannheim and Ludwigshafen, twin ports where the huge U. S. Army Rhine River Terminal handles the bulk of supplies for our forces in Germany. To the eastward, on the Neckar River, a tributary of the Rhine, lay Heidelberg. I could dimly make out its red sandstone castle, overlooking famed Heidelberg University.

Welcome Uncertain in French Skies

Near Karlsruhe, Joe veered slightly east of the river, then continued parallel to it. I realized suddenly that we had left the all-German Rhine: The river had become international. The opposite bank belonged to France, as part of her easternmost region, Alsace. France’s withdrawal from the North Atlantic Treaty Organization made permission to fly over her air space uncertain, and Joe stuck to the German side.

Happily, we could still look. As we came in sight of Strasbourg, the graceful and historic capital of Alsace, I caught the glint of canals drawing together on the city from distant rivers of France — the Rhone, the Marne, the Saone — bringing Strasbourg wealth and importance as a great crossroad of commerce (pages 472-3).

Above the colorful plain of orange-tiled roofs, the single spire of Strasbourg Cathedral stood out in dark perfection. Victor Hugo found it more inspirational than cathedrals far more famous. “I have seen Chartres and Antwerp”, he once wrote. “I needed Strasbourg”.

Victor Hugo was born too late to see Strasbourg Cathedral in its day as a symbol of revolt. During the French Revolution, overzealous patriots threatened to pull down the Gothic spire as the relic of a royal age. Cooler minds prevailed,

Triptych of Basel captures scenes that defy change. Crowds on a riverside terrace await the drop of a starting flag for an old-fashioned rowing contest. Oarsmen, members of an athletic club, race the clock in versions of the riverman’s traditional scow. Slender towers and cross-hatched roof of Basel’s medieval cathedral rise on the far bank. A man and woman enter the filigree-iron gate of Basel’s venerable Rathaus, the town hall. Top-hatted chimney sweep balances tools of a timeless trade on his way to work past the mist-shrouded cathedral. Only the portable vacuum cleaner on the front wheel of his bicycle smacks of the 20th century.

and for a time the stately tower wore a gigantic red cap — the Jacobin badge of liberty.

Strasbourg the city is accustomed to such lightning changes of rule. From its Bronze Age beginnings as a Celtic river encampment, it has been besieged, occupied, annexed, and liberated by half a dozen peoples — and, in turn, it has captivated all of them.

The enchantment today is unmistakably French, and the appeal is universal. I walked one morning through Strasbourg's cobbled squares and along quiet canals whose half-timbered houses wore their window boxes like cherished campaign ribbons.

The sound of Strasbourg is largely French, with a trace here and there of harsher German. No such mixture infiltrates the city's place names; nearly all have the distinct Gallic touch. Within a few blocks of each other I passed the Marché aux Cochons-de-Lait and the Rue du Jeu-des-Enfants — Market of the Suckling Pigs and Street of the Children's Game.

Elsewhere Strasbourg presents a formal side. On the edge of one broad park stands an ornate building, Le Palais du Rhin. Here the six nations most concerned with Rhine River affairs — Germany, France, Switzerland, the Netherlands, Belgium, and Britain — meet periodically to discuss problems concerning the river.

City's Fame Fattens on Goose Liver

For a city of charm and sophistication, Strasbourg has a curious symbol — the barnyard goose. The reason is an epicurean delight known as *pâté de foie gras*. Literally, the term means "paste of fat liver" — in the case of true *foie gras*, goose liver that has been greatly enlarged through forcible feeding of the bird. Strasbourg produces more than half of Frances supply of the delicacy, including 80 percent of the total exported. It does it with skill, two centuries' experience, and something like military secrecy.

I called one morning at F. Feyel, one of Strasbourg's oldest and most respected *foie gras* firms. With François Fischer, a young member of the firm, I visited the spotless kitchen with its huge vats for boiling the livers, and adjoining rooms where white-smocked women sort, weigh, and mix the ingredients. We ended in M. Fischer's office over a slice of the final product.

M. Fischer showed me how to pare away the outer ring of lard and an inner lining of pork that absorbs excess fat from the pâté. What remained was rich and delicate, but M. Fischer had reservations. "It is several degrees too warm", he announced.

Every good foie gras maker views his competitor's product with the utmost Gallic scorn, yet the basic ingredients for all are the same — goose liver, pork, lard, and usually a core of truffle, the highly prized subterranean fungus. I asked M. Fischer what distinguishes the various brands, and he answered simply, "Seasoning". What types of seasoning? M. Fischer was apologetic.

Thundering avalanche of water rages over the Rhine Falls, a 65-foot-high step in the riverbed near Schaffhausen. Swollen by the spring and summer thaw in the Alps, the river cascades from the huge parapet at the rate of 13,000,000 gallons a minute, spectacular by European standards though only about a seventh of Niagara's average. Boatload of sightseers braves swirling water and perpetual mist to visit an island dividing the falls at mid-river.

Like a berthed ship, the German island of Lindau in the Lake of Constance lies tethered to shore by a bridge and a railroad causeway. Freight cars roll directly onto ferries for delivery to other lake ports. Originally a fortified Roman outpost, Lindau has become a popular resort. Only seven-tenths of a mile long, the crowded island lacks space for a cemetery, which must be located ashore.

highest major port on the Rhine (map, upper Rhine, page 475).

From either side the land begins once more to close in on the river, this time never to release its grip. On the east rise the somberly beautiful hills of the Schwarz Wald, Germany's Black Forest. From the west, gradually narrowing the fertile margin of Alsatian farmland, come the Vosges and Jura Mountains of France. Near where the ranges meet, at a sharp bend in the Rhine, lie the city of Basel and the junction of West Germany, France, and Switzerland (pages 476-77).

The meeting of mountains, nations, and a river long ago created an international city. In 2,000 years the tides of war, migration, and trade have swept Basel from nearly all points of the compass. None overwhelmed the city, yet few receded without leaving a high-water mark of influence.

Along the steeply winding streets and trim courtyards of their divided city — Greater Basel on the south bank of the Rhine and Little Basel on the north — Baslers are constantly reminded of their predecessors: Celts, Romans, Huns, and Franks.

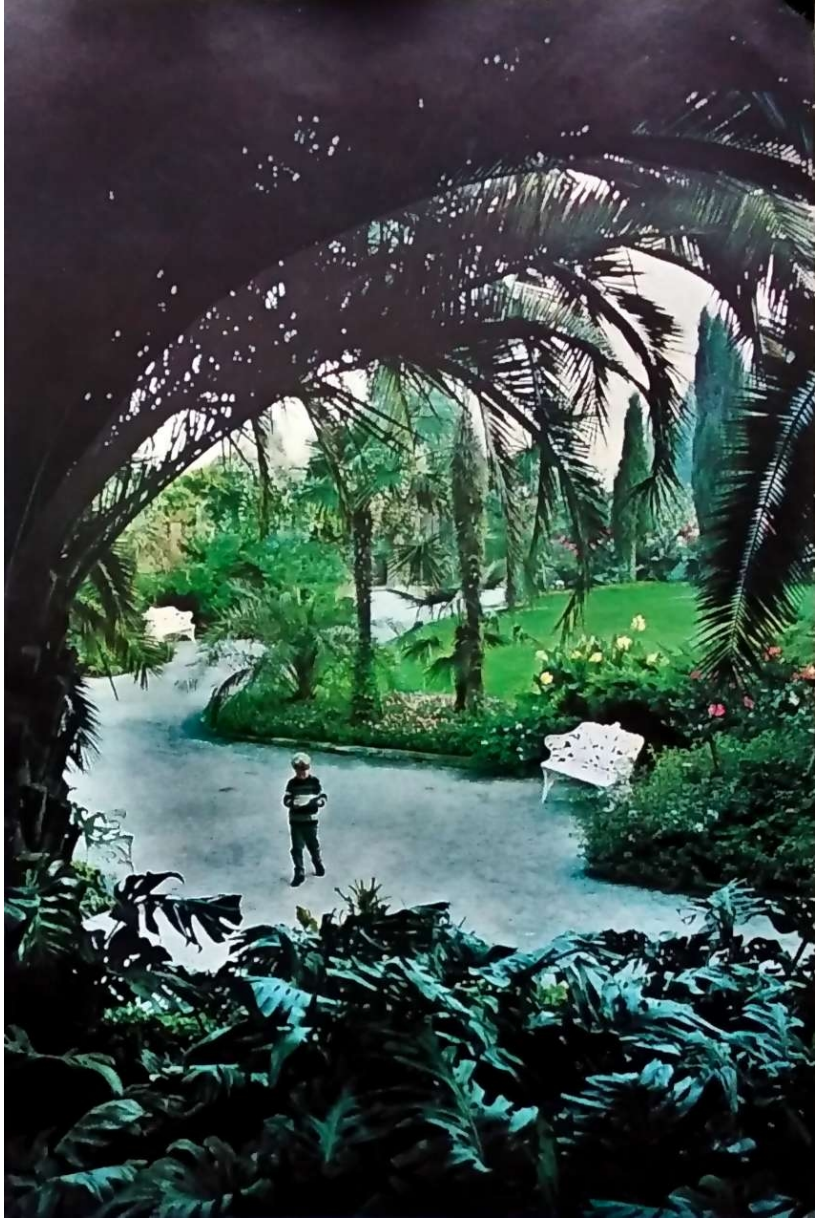
Basel, however, is more than a display window of history; it is Switzerland's threshold on the world. Nearly 500 miles of river separate it from the sea, yet its modern port handles 8,000,000 tons of goods a year, a fourth of all Swiss foreign trade.

"Believe me, I cannot tell you, even for Feyel foie gras. It is something known only to our president, M. Bijon, who has the original Feyel family formula — whether in his head or on paper, who can say?

"Once a year at night, M. Bijon takes many spices into a certain room and bolts the door. We do not even know which spices he actually uses and which ones are" — M. Fischer searched for the word — "decoys.

"When M. Bijon comes out, Feyel has a year's supply of seasoning. But the secret stays behind in the room."

Above Strasbourg the Rhine becomes a giant escalator, in the form of a man-made channel, the Grand Canal d'Alsace. Seven massive locks climb to the Swiss city of Basel,



Tropic lacework of palms garlands Mainau, an island in the Lake of Constance belonging to Count Lennart Bernadotte, nephew of Sweden's King Gustav VI Adolf. The lake's even temperatures create an outdoor greenhouse for imported palms, citrus trees, and prized California redwoods planted by the present owner's great-grandfather. A visitor strolls the graveled walks with a map of the island.

"Switzerland", one Basel shipowner summed it up for me, "is a flower on a long stem — the Rhine."

Among other customers, the port of Basel serves one of the world's great chemical and pharmaceutical centers. Four giant Swiss firms located along the Rhine — Ciba, Geigy, Sandoz, and Hoffmann-La Roche — have earned Basel the respect and gratitude of millions in their endless campaign against human misery and disease.

Victories in the war are often dramatic. Recently Ciba reported a promising new treatment for schistosomiasis, a dread and often fatal parasitic disease afflicting an estimated 200,000,000 people, mainly in tropical lands.

"Disease anywhere is a challenge to Basel", one medical researcher told me. "There are no races or colors in the laboratory."

Egg Evidence Dooms "Guilty" Rooster

Science and Basel have come a long way since the day the black rooster went on trial. The year was 1474, the place a public building in Basel, and the charge — a capital offense — laying an egg.

"The town tried to be fair about it", Fräulein Els Havrlik explained when I called at the Swiss Institute of Folklore. I had read of the bizarre trial, and she added details.

"The court appointed a lawyer for the rooster", Miss Havrlik continued, "but his chances were pretty slim. For one thing, the bird's age was against him." I looked puzzled, and she gave me a patient smile.

"In medieval times people had strange notions about birds and animals, and one of them was very explicit: If a black rooster over seven years of age laid an egg, the egg would hatch a basilisk, a sort of miniature dragon whose look meant instant death. Of course roosters have been known to lay small eggs, and they caught this rooster in the act.

"I'm afraid things went badly from the start", Miss Havrlik said. "Everybody was terrified. Someone swore the rooster was over seven years old, and apparently they had the egg in evidence. The defense lawyer was helpless. The court sentenced the rooster and the egg both to be burned, and they carried out the sentence on a height called Kohlenberg.

"But you mustn't think too badly of Basel in those old days", she concluded gently. "They once hanged a pig for murder in France."

Above Basel the Rhine begins to lose the sober look of a mature river and to hint at its brawling youth in the Alps. The current flows smoothly, but the pace is often swift, as though the river were in a rush to gain substance and the fullness of age.

Excursion boats outnumber cargo ships in the locks between Basel and the smaller up-river ports of Rheinfelden, Säckingen, and Waldshut. For here the Rhine is more ready to please than to serve, and the land seems to sense the change. Small cameo towns and villages lodge against the dark slopes of the Schwarz Wald, and the pungence of fir and pine takes the place of industrial fumes.

Switzerland and West Germany appear undecided over ownership of the paradise. The south bank of the Rhine is wholly Swiss, but maps give the northern side the look of a badly warped chessboard. Between Basel and the enchanted town of Stein am Rhein, just below the Lake of Constance, motorists hugging the river's northern bank cross the Swiss German frontier a total of eight times — and end up back in Switzerland.

Border Posed Chimney-sweep Problem

The tourist's delight is the resident's misfortune, for the patchwork frontier has its drawbacks. Tiny Verenahof, for example, a plot of several acres with three families in residence, was until very recently German territory entirely surrounded by Switzerland.

Now and then Verenahof needed its chimneys cleaned, and the chimney sweeps of neighboring Swiss towns were glad to oblige. During World War II, however, German law required that German chimneys be cleaned only

Graceful forehand sparks a rally at Bad Ragaz, a resort on the Swiss Rhine. Guests of all ages flock to the spa to enjoy its incomparable scenery and its system of natural hot springs.

Cycling into action, combat-ready Swiss soldiers pass a power station during maneuvers near Chur. Swiss law requires part-time military training for men between 20 and 50.

by German experts. So Verenahof dutifully — and at considerable expense — sent across ten miles of Switzerland to arrange the job.

The commercial Rhine meets a spectacular end at the Rhine Falls just below Schaffhausen (pages 480-1). In a single thunderous stroke, the great barrier fall virtually separates a powerful servant of man from a scenic wonder. Except for hydroelectric stations and scattered industry along the upper Rhine, the river gives itself over to beauty.

Swiss Guard Against Fish Smugglers

Beauty takes one of its most spectacular forms in the Lake of Constance. The huge natural reservoir, known to Germans as the Boden See, fills a 42-by-8-mile gap amid the mountains of Switzerland, West Germany, and Austria, at one point reaching a depth of 827 feet.

Constance, in effect, provides the Rhine with a vast expansion tank, absorbing the river on the eastern lakeshore near the Austrian town of Bregenz and releasing it at Germany's Konstanz in the west.

On an average, the Rhine takes a leisurely two months to make its 42-mile journey through the lake. Happily for towns downriver, the expansion tank temporarily swallows floods; for days at a time, the Lake of Constance may release as little as a tenth of the water it receives.

But the fame of Constance rests more on recreation than on flood control — its fleet of pleasure boats numbers an estimated 5,000. Yachtsmen encounter few border formalities among the three lakeside countries. Other lake dwellers are less privileged, as I learned on a cruise with Hans-Georg Meyer, a senior Swiss customs official.

In a fast government launch we cruised the southern shore of the lake and made a swing around the western island of Mainau. Among the flags on boat sterns everywhere, Austria, West Germany, and Switzerland were well represented.

"The frontiers run far out into the lake itself", Inspector Meyer explained, "but we do not enforce them for sailors. Even when an Austrian or German boat comes ashore in Switzerland, we merely ask the owner to let us know if he plans to stay longer than a day.

"With fish it is different", he added, smiling. "A fish must pay to enter Switzerland."

Fish prices, he explained, are lower in Germany and Austria than in Switzerland, and some anglers are not above a little profitable smuggling. Perch, trout, or eel caught on the German side of the lake are liable to duty when brought to the Swiss shore.

"A fish may cross under the border as often as he likes", Inspector Meyer concluded. "But we charge him to ride over it in a boat."

Youthful Rhine Serenades a Valley

Between Constance and the high Alps that give birth to the Rhine, the river is virtually an endless cascade. Over the first 45 restless miles of its life, the Rhine drops a vertical distance of a mile through superb but often hostile land, itself a harsh newcomer in terns of geologic age. Here the broad bed at the Rhine

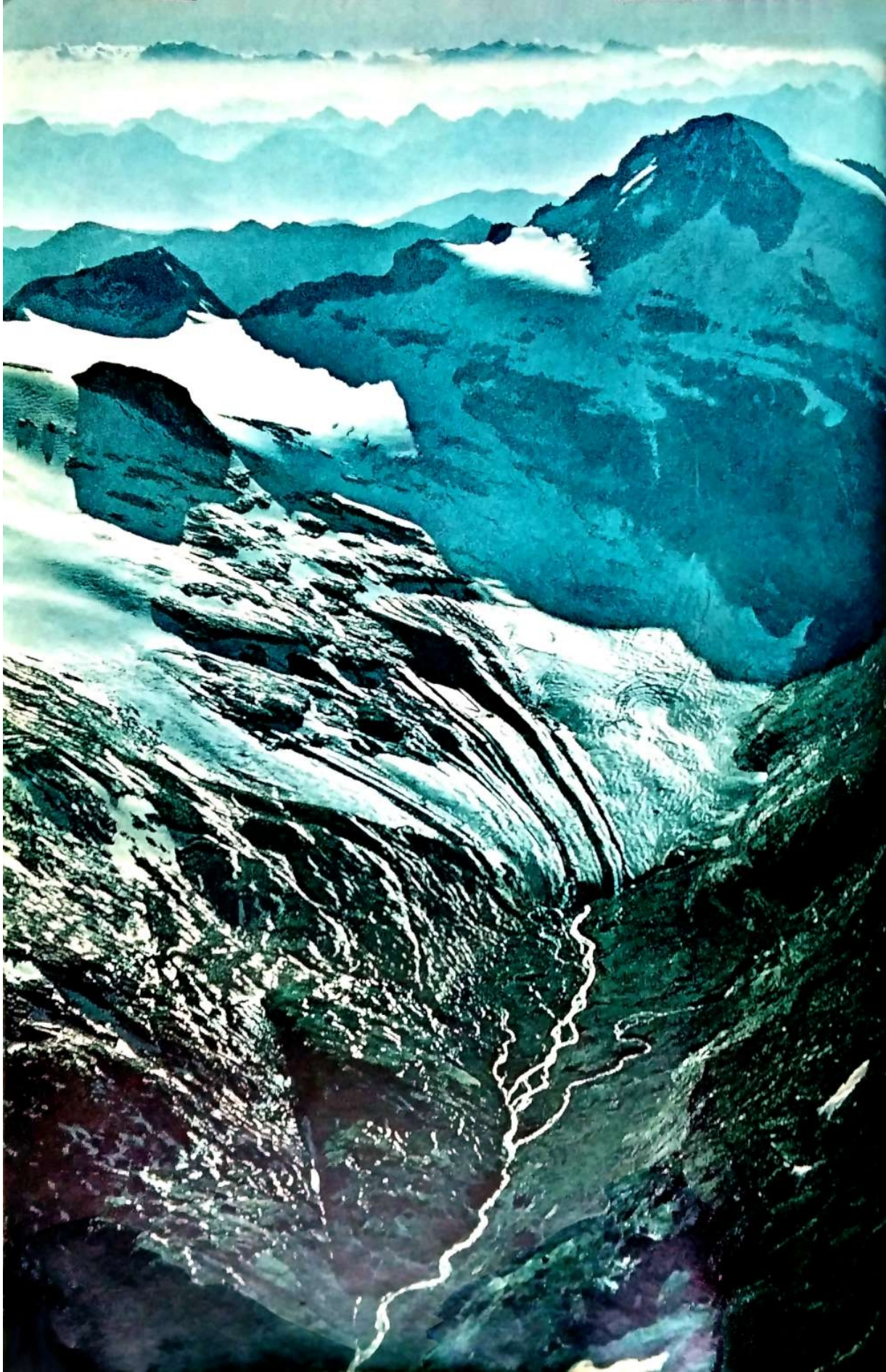
Canvas village sprouts like a cluster of bright mushrooms beside a branch of the Rhine at the Swiss town of Andeer. A covered bridge spans the river, known here as the Hinter Rhein, or Farther Rhine. Even in July, Alpine campers risk instant shifts of weather, as revealed in the scene above: Bruce Dale took the picture the morning after he photographed the camp on a clear evening at left. Unconcerned, the girl lifts an umbrella and shakes snow from her tent.

becomes a Spartan cradle whose ice-crowned walls soar thousands of feet high and whose narrow floor is rough-chiseled from the hearts of mountains.

Centuries have softened some of the strokes of the chisel, bordering the Rhine with high Alpine meadow and darkening lower slopes with evergreen. Pine marten, roe deer, chamois, and raven share the green sanctuaries with two naturalized Alpine dwellers, man and his docile companion, the Brown Swiss cow.

In the way of great beauties, the young Rhine has a temper, and more strength than the lowlander imagines. Driving south — and always upward — with the Rhine as it divides Switzerland and Austria, I crossed for a time into Liechtenstein. The small principality, justly famous for its decorative postage stamps, is a superbly fashioned postage stamp itself. Bordering the right bank of the Rhine, its 61 square miles run to moss-green farmland, Hans Christian Andersen villages, and a castle or two all but blending in silhouette with the surrounding crags (pages 496-97).

In Vaduz, the capital, I talked with Father Anton Frommelt, who in 72 years has combined careers as a priest, a onetime leader of the Liechtenstein Government, and a gifted designer of some of the country's finest stamps. I asked him how a lifelong artist looked at the Rhine. His answer might have been that of a composer rather than a painter.



“The Rhine is a song, an anthem in our valley”, Father Frommelt said, “the first music many of us hear as children, and often the last we hear at the end of life. It is a changing song, sometimes joyful, sometimes sad, and once upon a time it was the song of violence.”

River’s Voice Remains Young and Clear

Other Liechtensteiners had told me that in 1927 the Alpine Rhine burst through the protective levees along Liechtenstein’s river-bank and raged through the countryside, smashing villages and claiming more than half the principality’s precious 30 square miles of living space. In the years before levees, the spring invasion took place more regularly but with less devastating surprise.

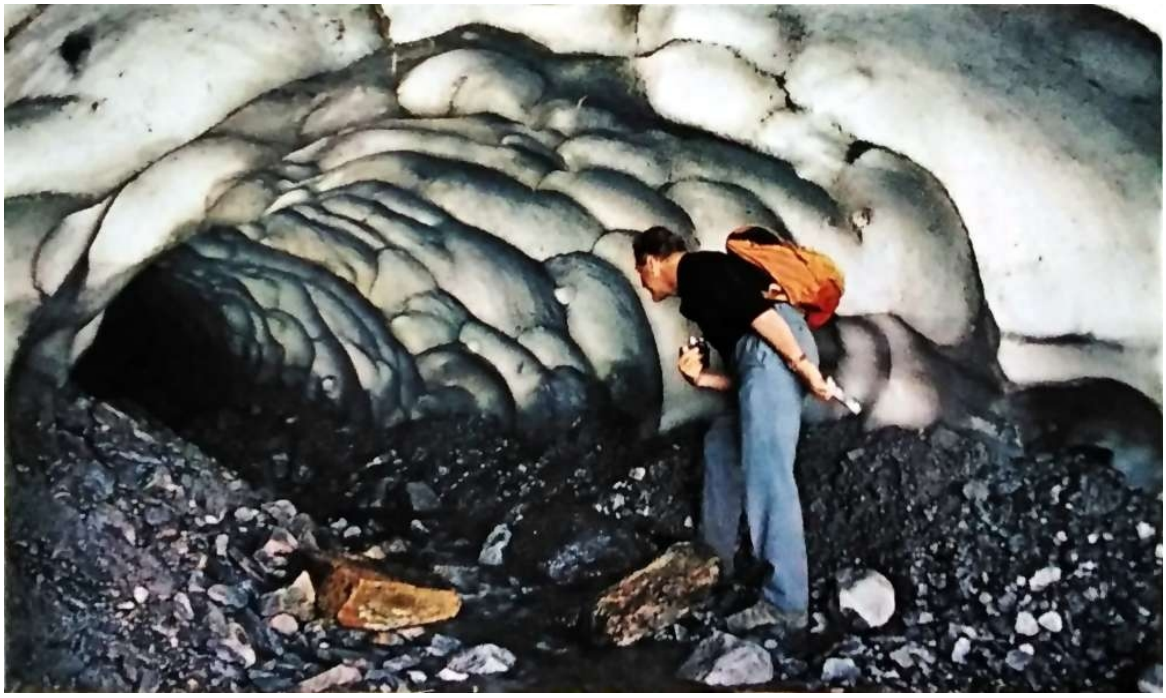
“The Rhine no longer comes to our doorstep to sing”, Father Frommelt said, “but it is still young and strong and the voice is clear — our valley will always have music.”

Beyond Liechtenstein I came to the birthland of the Rhine. Maps call the area the Grisons, a section of the Alps made world-famous by the skiing citadels of Davos Platz, St. Moritz, and Arosa.

But the Rhine is born in a less fashionable part of the Grisons; no ski tows or runs etch the endlessly white realm of glaciers and snow fields that give it life. Its sources lie westward of the great winter playgrounds, among features better known to the Alpinist and the solitary hiker — Stallerberg, Rheinwaldhorn, Piz Badus, Lake Tuma.

South of the city of Chur, at Reichenau, the Rhine becomes two streams, the so-called Nearer and Farther Rhines — Vorder Rhein and Hinter Rhein. The Nearer Rhine issues from a western valley, its flow well swollen by side streams and mountain falls on the way from its main source, Lake Tuma, beneath the 9,603-foot crag of Piz Badus.

The more spectacular Hinter Rhein reaches Reichenau through a fearful gorge still known as Via Mala, the “Evil Way”. The great cleft earned its name from the Romans, who pushed north across the Alps and who watched more than one of their hapless companions lose his footing along cliffs towering 2,000 feet above the river.



Gleaming chalice of ice and snow, the massive Rheinwaldhorn Glacier spills the newborn Rhine in a crystal rivulet down the steep trough of the Hinter Rhein valley. Considered the river’s major source, the huge icefall in Switzerland’s eastern Alps paves a shoulder of the 11,162-foot Rheinwaldhorn peak. Born in a chill matrix at the glacier’s base, the young river emerges from the lip in scalloped tunnels such as the one above being inspected by a Swiss mountaineer. Several months later and a half a continent away, the trickle has swelled to a flood, surging into the North Sea at the rate of 146,000 tons of water a minute.

At the head of the remote Hinter Rhein valley lies the Rhine's principal and highest source, a vast scallop shell of ice at more than 11,000 feet, known as the Rheinwaldhorn Glacier (pages 488-9). Slowly, majestically, the great icefall releases a brook that bubbles cheerfully toward the valley below — a brook that, several months and half a continent away, becomes a torrent surging seaward with some 8,760,000 tons of water an hour.

Local Census Counts Cows and Goats

Having climbed to the Rheinwaldhorn and Lake Tuma, I paid a visit to one last source of the river, the Averser Rhein, beside Switzerland's highest year-round community. The village of Juf under the towering Stallerberg range claims 109 permanent residents. The figure is misleading, for Juf in its pride includes 60 cows and 30 goats in the private census.

Juf's 19 villagers inhabit a 7,000-foot-high valley watered by the Averser Rhein, a crystal thread everlastingly spun by snow fields far above the village.

Driving from Chur one late spring morning, I left the car in Juf and walked the valley slopes in the warming sun. Now and then above the cheerful mutter of the stream I could hear the chink of bells from Juf's grazing herds and the occasional alarm whistle of an alert sentinel, the Alpine marmot.

Spring in full color had celebrated the birth of the Rhine. Beginning on the lower slopes of the mountains, a great sweep of Alpine flowers reached down to the valley floor, spilling out at last beside the stream in a dazzling moraine of rose, gold, and violet. Following the banks of the stream, I ended up back in Juf at a small inn appropriately named Edelweiss.

I asked the proprietress, a kindly woman in her forties, if Juf received many visitors.

"In spring and summer, many", she answered with a wave toward her picture valley. "Who would not come for such a sight?

"But when the snow winds reach down into the valley, those who love winter come to see a different Juf. Between the two, we are seldom lonely, and if the life is a little hard, many pay a higher price for happiness."

Leaving Juf to its fragrant spring, I caught a fast cabin ship at Basel for the 3 ½-day voyage down the Rhine to Rotterdam. Summer had crept past the high barrier of the Alps and slipped north along the lowland reaches of the river.

Near Strasbourg early campers had taken possession of the banks, their tents clustered together in bright solids and stripes, like some child's huge building blocks left beside a stream. Other Rhinelanders had taken to the river itself. Everywhere squadrons of kayaks and foldboats raced the heavier traffic downriver, or dodged the leviathans straining upcurrent.

Beyond Mainz, just above Binger Loch, there was the welcome sight of a pilot boat alongside, and then suddenly we were through the dark jaws of the Rhine Gorge and out into the sunlight of the broad river at Koblenz.

The ruined towers of Remagen slipped by, then the low white buildings of Bonn, and finally the great double stalagmite of Cologne Cathedral. In the heavy traffic along the Ruhr I kept an eye out for my old ship *Weissenstein*, but she must have been busy on another stretch of the river. Then one evening we were through the Dutch border below Emmerich, and the following morning at our berth in Rotterdam.

Rhine Bells Ring a Warm Farewell

The doorway of the Rhine was crowded as always, welcoming seagoing visitors from all reaches of the world and exchanging their cargoes for those of a great continent.

I watched by the rail for a time as the tireless Rhine ships nudged their way under waiting cargo cranes or dropped lines and sheered away, loaded and bound upriver.

Now and then across the water I caught the triple chime of a ship's bell, as if in signal to all Europe along the Rhine: "In God's name, a good voyage."

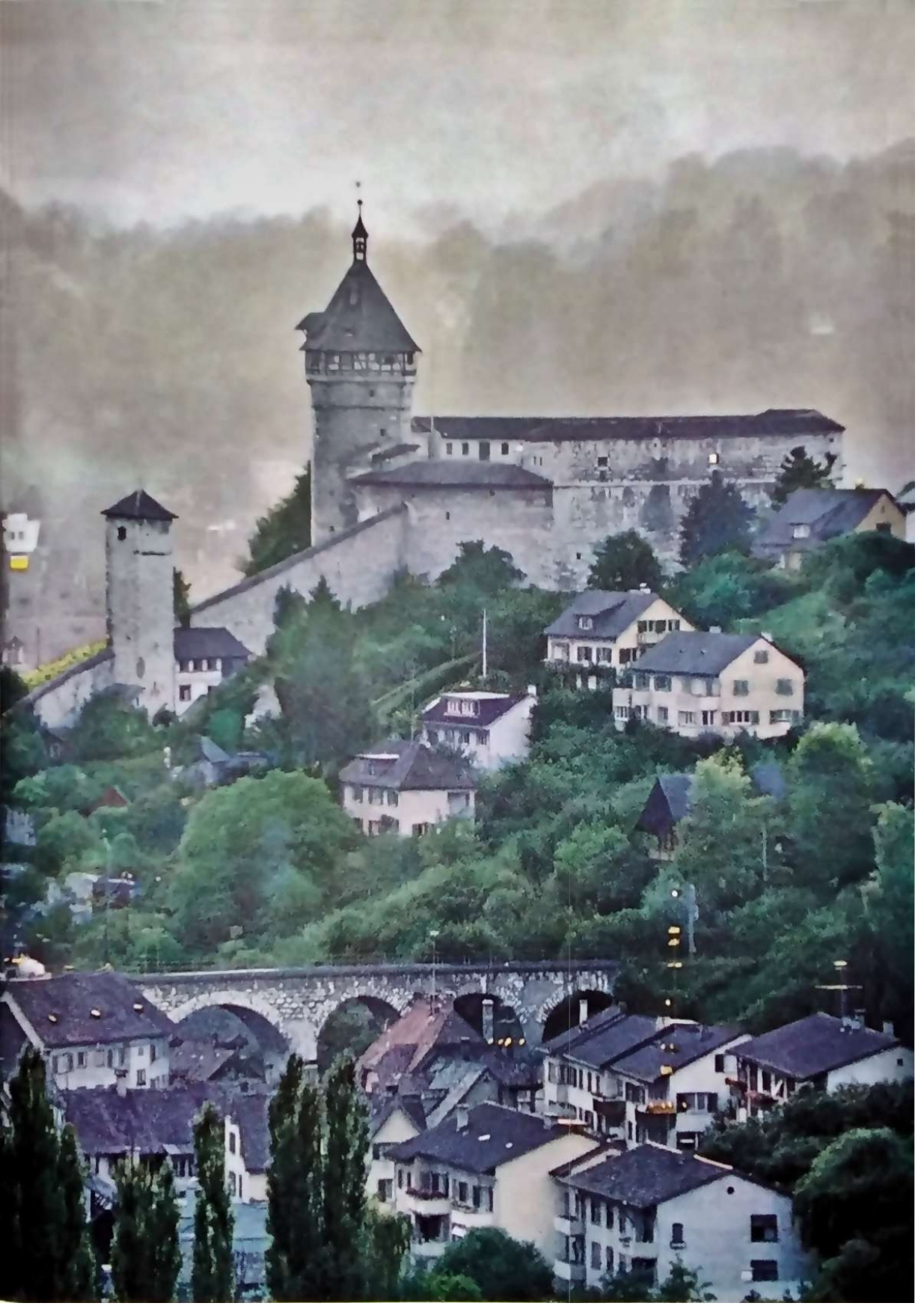
THE END

Outward bound on a copper river, a lone coaster bids the Rhine farewell at Rotterdam in the last light of day. A distant radar station, one of seven installed to track vessels in and out of the estuary, raises forklike masts above the Hook of Holland, a finger of land marking the Rhine's frontier with the North Sea. Radar operator below monitors a glowing scope pinpointing traffic passing through the port's seaward jetties.

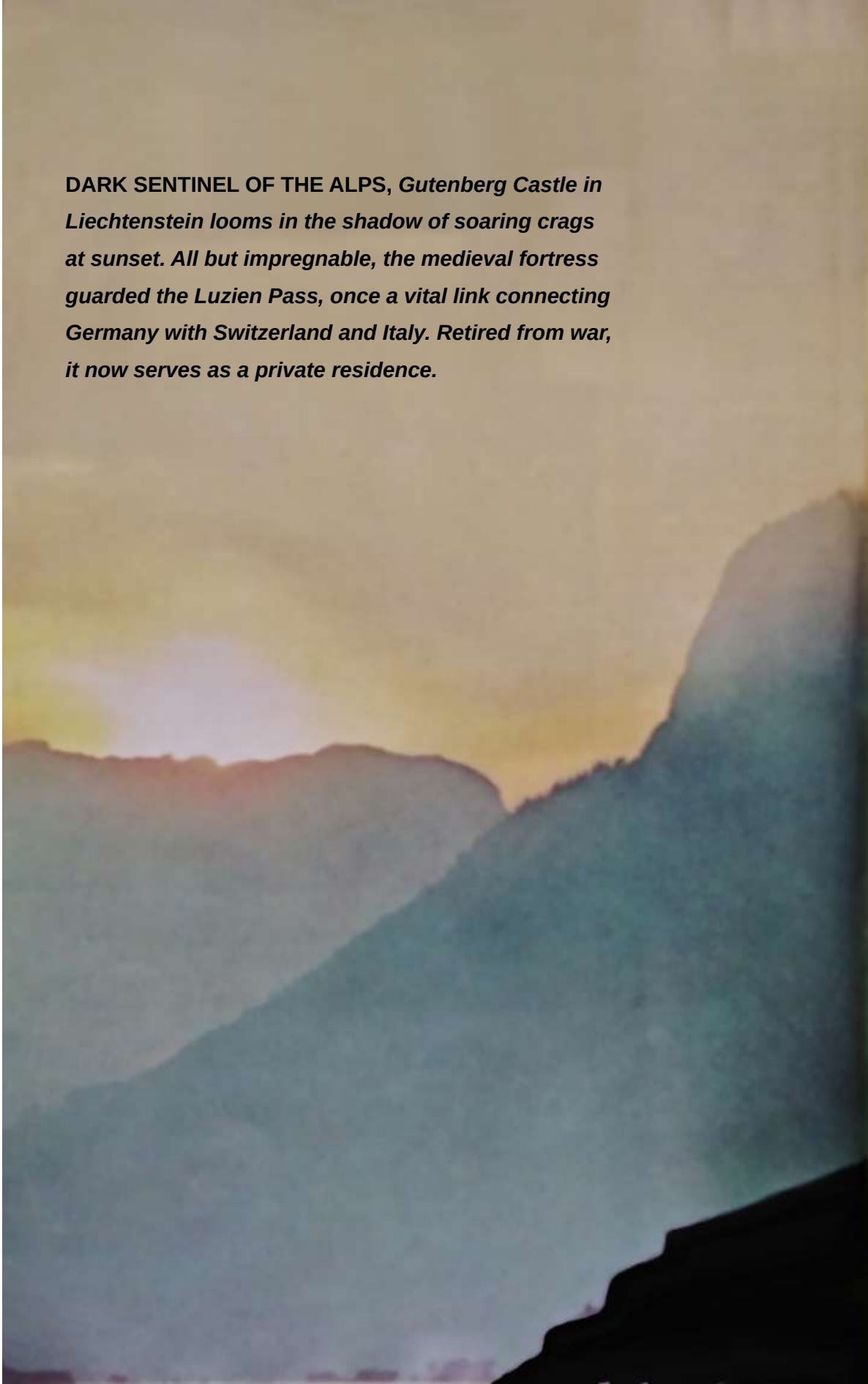
Vineyard ramparts gird Burg Katz, a citadel on the heights above St. Goarshausen. Count Johann of Katzenelnbogen built the “Cat Castle” in the 14th century. Destroyed by the French in 1804 and later rebuilt, it now houses a convalescent home.

Medieval knights, warring among themselves and levying tolls on ships, fortified the cliffs of the Rhine Gorge — a deep slice through Germany's Taunus Mountains. As restaurants, museums, and youth hostels, Rhine castles today welcome visitors by the millions.

Rose-colored cloud of sunset envelops Schaffhausen, a small Swiss enclave on the northern, German bank of the Rhine. Like benches in an amphitheater, houses climb the slopes toward



the 16th-century fortress of Munot, whose broad roof provides an open-air dance floor in summer. Clock tower of the Monastery of All Saints dominates the center of town.



DARK SENTINEL OF THE ALPS, ***Gutenberg Castle in Liechtenstein looms in the shadow of soaring crags at sunset. All but impregnable, the medieval fortress guarded the Luzien Pass, once a vital link connecting Germany with Switzerland and Italy. Retired from war, it now serves as a private residence.***

Cross-country by sailboat

STEP ABOARD *YANKEE* — and see Europe from a sailboat.

Travel takes on a new dimension Saturday evening, April 8, when the Columbia Broadcasting System presents "*Yankee* Sails Across Europe", latest in your Society's hour-long color television series.

With Irving and Electa Johnson — veterans of seven trips around the world in two earlier *Yankees* — you will visit France, the Netherlands, Denmark, Germany, and Belgium in their newest ship of that name.

Instead of New Guinea head-hunters, the Johnsons rub elbows with a strange breed, the barge-men of Europe's canals. With their families, many spend their lives afloat.

Battling swift Rhone River currents with its auxiliary diesel at full power, the 50-foot ketch barely inches past the bridge at Avignon, famed in children's song. The clipper-bowed vessel climbs the locks of central France through fields of flowers.

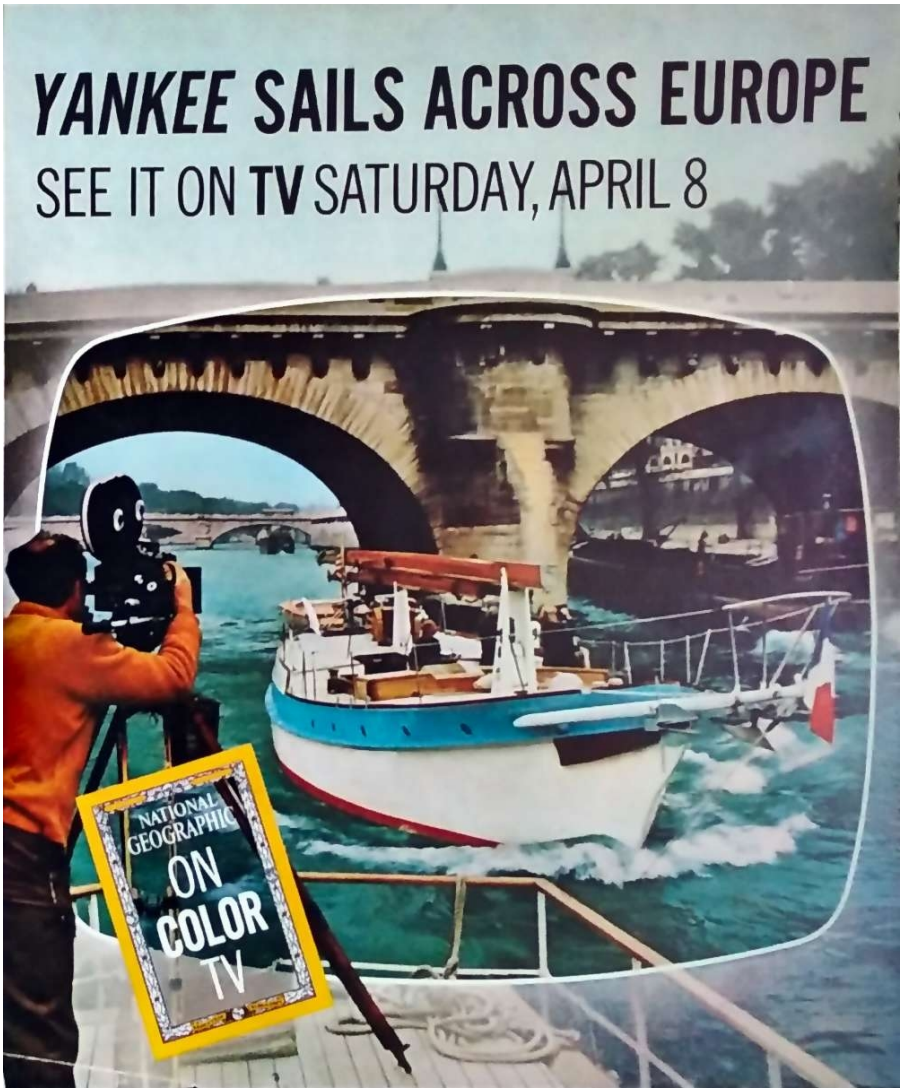
Down the storied Rhine, the Johnsons dodge a floating traffic jam of barges. In the Netherlands, they see the world championship canal-vaulting contest.

Tivoli's whirling rides and laughing children bid welcome to Copenhagen. Among Hamburg's fat freighters, the Johnsons discover a four-masted bark, a nostalgic reminder of Irving's young sailing days around Cape Horn. In the Frisian Islands, *Yankee* runs aground on treacherous sands, and Irving rescues a hiker trapped by rising tides. Turning inland again, the Johnsons sail Belgium's Ardennes and follow the Seine through the heart of Paris.

Produced by your Society in association with David L. Wolper and narrated by Alexander Scourby, the program is sponsored by Encyclopaedia Britannica, Inc., and Aetna Life & Casualty.

Landlocked voyager, *Yankee* explores Europe by river and canal. Masts folded, she crosses the Moselle River by aqueduct in France; cyclists and gold-tressed maid welcome the ketch to the Netherlands.

JOSEPH J. SCHERSCHEL; IRVING JOHNSON; *YANKEE* GLIDES PAST A SEINE BRIDGE IN PARIS BY FRED WARD, BLACK STAR © N.G.S.



New Grandeur for

By JOSEPH JUDGE, National Geographic Senior Staff

LIKE A GOOD MANY NATIVES of the Nation's Capital — buffeted by civic change, jostled by national events, hounded by tourists, and elbowed by hordes of sophisticated newcomers — I am a perverse, provincial, and melancholy man.

I like few things better than a brooding afternoon at winter's end when the Congress is somnolent, the President is out of town, a raw mist shrouds the city's magnificent vistas, and a single sad bugle sings from Arlington's gray hill. Then might a native son pursue in peace his parochial rounds — to a silent Phillips Collection gallery to admire again that glass of ruby wine in Renoir's "Boating Party"; to an uncrowded Museum of Natural History to shudder before that Cheyenne necklace of human fingers; to the Rare Book Room of the Library of Congress to re-read the journal of Henry Spelman, slain by Indians along the Potomac in 1623; and

Flowering Washington

Illustrations by National Geographic photographer JAMES P. BLAIR

finally to the lonely towpath of the Chesapeake and Ohio Canal where, in the last luminous light of a rifting sky, winter jasmine glows like a candle flame, setting early spring afire.

No other kind of day will quite do, either, for that long journey into a man's past — to the old neighborhood of brick row houses where I spent the first seven years of my life. I had in mind a particular oak I longed to see — a galleon of adventure whose leafy sails unfurled to the winds of fortune and the iron whims of her young master. Ho for the Spanish Main, the Isles of Spice, Zanzibar…

I do believe my heart skipped a full beat when I turned the final corner. The old oak was not there. My first home was not there. The entire block where once had lived the McCarthys, the Rices, the Judges, the Walkers, the Petrones was not there any more. In its place was a rubble-strewn lot where a damp wind casually folded the pages of a month-old newspaper.

Capital's Greatest Change in Progress

Forlorn, I stumbled through the pulverized brick until I found a friend, a battered lamp-post still standing. In those bygone years, it had served as third base in our stickball games. As I leaned against it, remembering evenings thick with fireflies when we gathered there to play kick the can, a small boy sauntered by on his way home from St. Gabriel's School. I summoned him.

"Why did they knock these houses down?" He considered for a moment. "I expect they're knocking this whole town down."

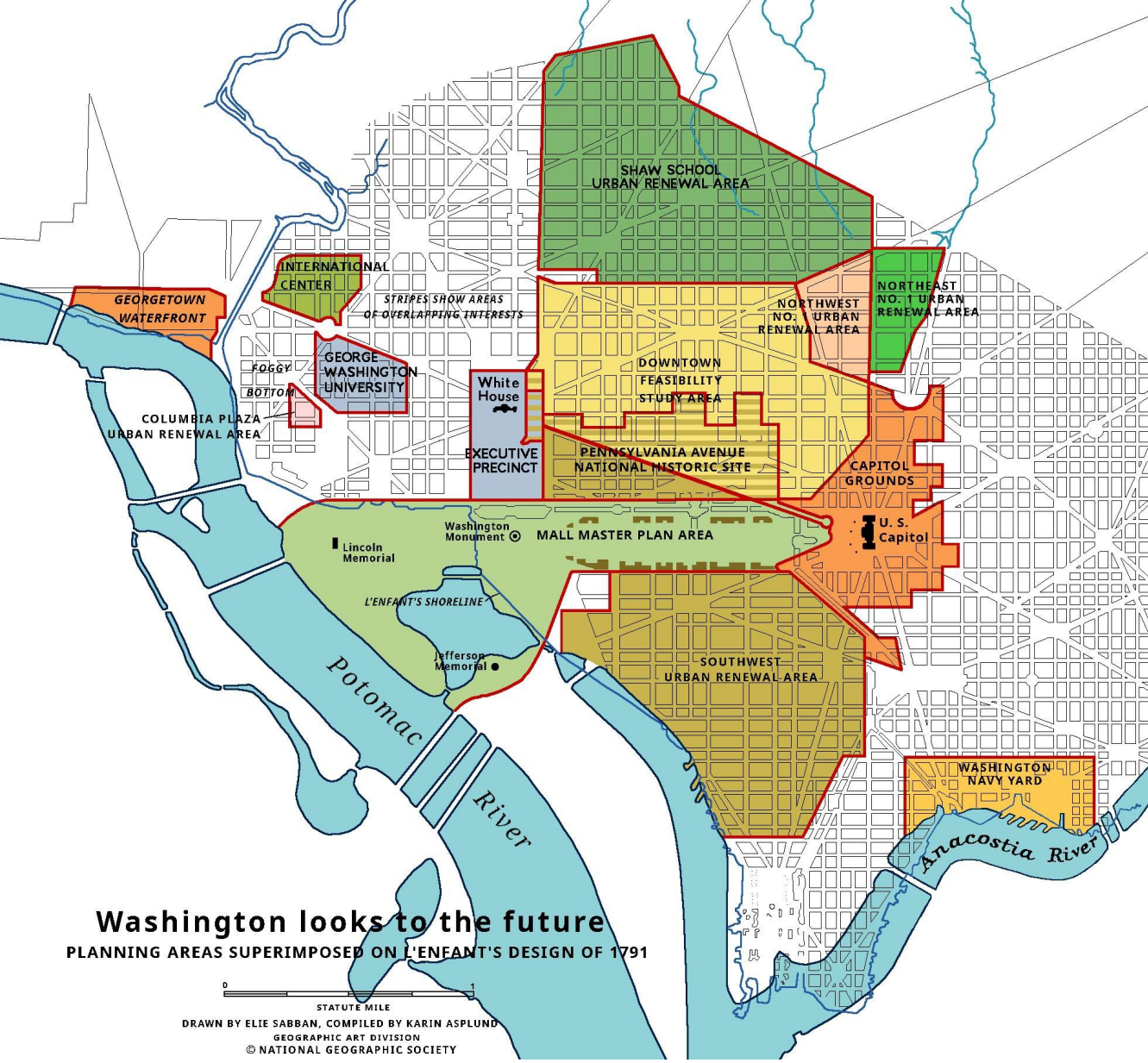
"Nobody asked me about it", I said.

He shouldered his book pack, mumbled to himself, and went on his way.

In the days and weeks that followed, I found that obliteration of the scenes of my childhood is only a fraction of the most ambitious transformation in Washington's history. Planners, politicians, and private investors are renovating, remodeling, and rebuilding almost the entire Federal City that appears on Maj. Pierre Charles L'Enfant's enduring original plan (next page). The Nation's First Lady is strewing multitudes of flowers, shrubs, and trees in every public place. In another ten years, my humble

Glory of nature and strength of man combine in Washington's splendid landscapes; the gleaming Capitol, in a frame of magnolia blossoms, lifts its Statue of Freedom high above the skyline.

Cherished for its verdant beauty and majestic monuments, the city today ventures extensive changes as it strives to realize the lofty vision of its planners.



Mosaic of change covers almost all the Federal City appearing on Maj. Pierre Charles L'Enfant's 1791 plan. He extended his streets into the Anacostia River, perhaps hoping the area would eventually be filled. Over the years, time and tide have altered the shorelines. In 1912 Army engineers reclaimed vast areas from the Potomac for now-verdant parklands.

South of monuments and museums along the Mall, the new Southwest nears completion after a decade of building. Northward, Pennsylvania Avenue faces major improvement, and businessmen launch a program to revive the downtown area. Foggy Bottom borders a proposed International Center for embassies. Georgetown's waterfront and the Navy Yard await redevelopment.

Carved from farmland, Washington in 1833 centered on a wooden-domed Capitol, on the hill beyond the Navy Yard. Warship lies moored in the Anacostia River.
[*City of Washington from Beyond the Navy Yard* by George Cooke]

home town will acquire the majesty and utility it has ardently desired but never quite attained since George Washington selected the site.*

The most striking symbol of the city's coming glory is the mighty boulevard that the President's Temporary Commission on Pennsylvania Avenue intends to make of that famous street.† Architect Nathaniel Alexander Owings, the commission's chairman and driving spirit (pages 505 and 531), is a man whose energy and enthusiasm get him up early.

A salmon sunrise silhouetted the frosty dome of the distant Capitol as Nat Owings and I jammed chilled hands into coat pockets and began a trek along the Avenue.

"I didn't think anybody was *born* in Washington", he said. "If you were, you must know that this was always intended to be a majestic ceremonial street — a physical symbol of our form of government. It is where our national dramas are played out. And it's in sad shape. Were you here for the Kennedy Inaugural?"

The question jogged my memory of that bitter-cold, wind-blown noon in 1961, and beyond that to other days when the bugles and banners of glory had marched down America's main street. I watched President Roosevelt's third Inaugural parade while clutching the marble knee stockings of Benjamin Franklin's statue at Tenth Street. I waved at happy Harry Truman from atop a building at Sixth Street, and I grinned back at Ike Eisenhower rounding the corner at 15th. Astronauts and kings had paraded by me.

The reminiscence brought to mind events I had not seen — Thomas Jefferson's pleasant gallop in 1805, "followed by a large assemblage… and strangers of distinction" who made up the first of 41 Inaugural parades; Andy Jackson's ragtag throng of admirers sweeping the frontier toward the White House; the tumultuous two-day victory review of the Union armies (page 511), climaxed by cows, chickens, carts, and dancing former slaves; Coxey's Army of the unemployed in 1894; the Bonus March of 1932 — a century and a half of America made manifest, marching now in phantom ranks.

Plan Born During Inaugural Parade

I recalled, too, the beat of muffled drums, the creak of the caisson, the clatter of the riderless horse as President Kennedy's cortege went by. He was one of seven Presidents who have made that longest of all journeys along the Avenue. But we had been talking about his Inauguration.

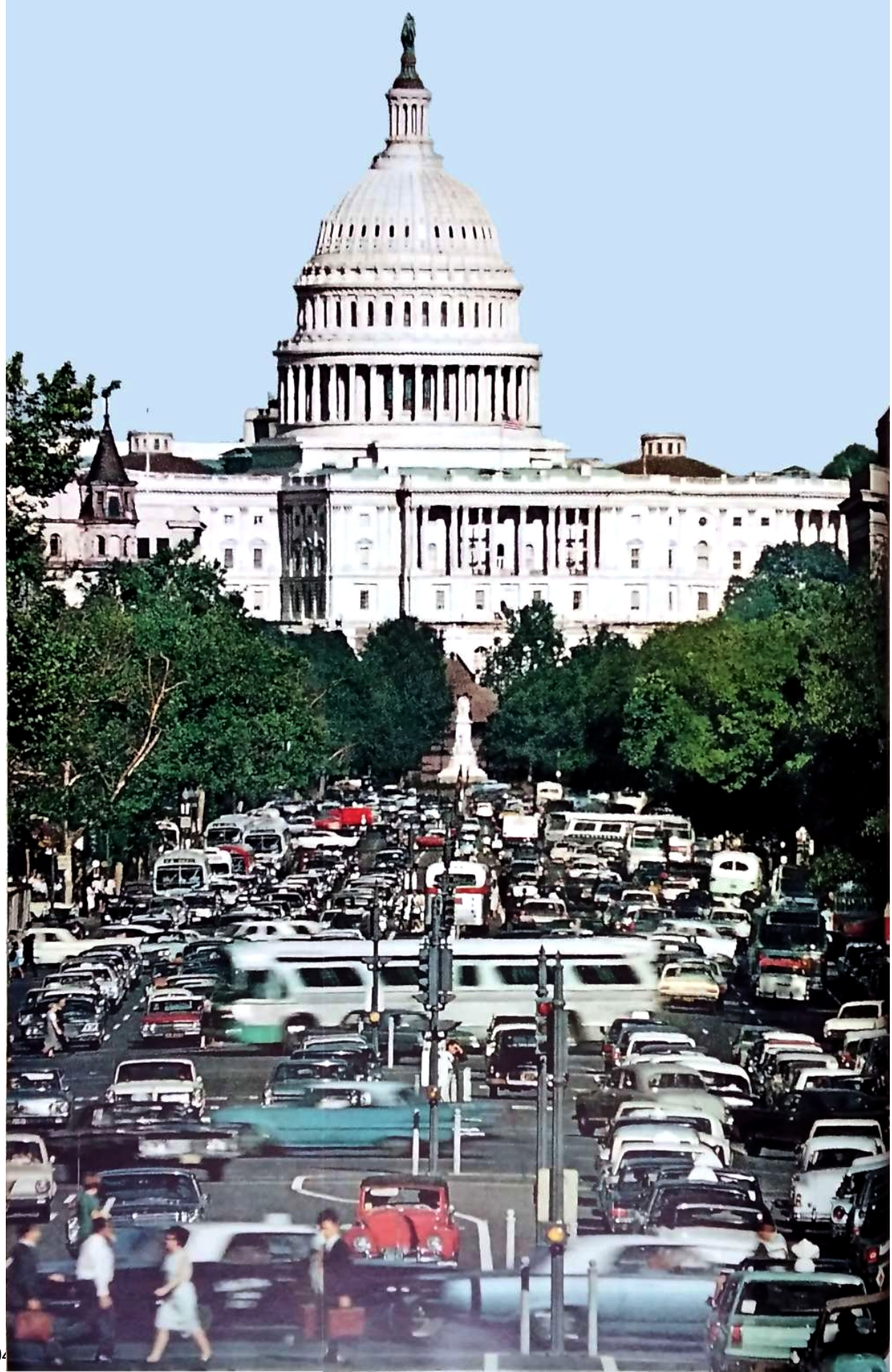
"Yes", I said, "I was here. I remember."

"That is the day this plan was born", Mr. Owings said. "During the parade, both the President and Arthur J. Goldberg, then the new Secretary of Labor, took a good look at the north side of the Avenue. They realized that an

* See "Washington: The City Freedom Built", by William Graves, NATIONAL GEOGRAPHIC, December, 1964.

† Dorothea and Stuart E. Jones described "Pennsylvania Avenue, Route of Presidents", in the January, 1957, GEOGRAPHIC.

PRINT COURTESY I. N. PHELPS STOKES COLLECTION, NEW YORK PUBLIC LIBRARY



important part of the L'Enfant plan was a shambles. Later they talked it over, and that eventually led to the Pennsylvania Avenue Commission and its plan."

The first rivulets of traffic from the morning tide were flowing onto the Avenue as we crossed diagonals and dodged through intersections. On the south side, the imposing façades of the Federal Triangle, begun in 1929 and never quite completed, sloped against a rosy sky. But to the north, the morning sunlight seemed to search out every grimy window, cracked cornice, and dingy doorway of tired and neglected private buildings, their age emphasized by the few new or refurbished structures along this side of the Avenue.

New Life for an Urban No Man's Land

"One of the troubles", Mr. Owings said, "is that the Avenue has never been considered as an area in itself, but only as the edge or end of something else — the northern edge of the Federal Triangle, the southern edge of the city's business district. As a result it has become a run-down no man's land, beginning more or less around the Capitol and ending somewhere around the Treasury and White House, with traffic jams in between.

"A great Avenue deserves a real beginning and a dramatic climax. The commission has treated the north side in depth, with superblocks of new buildings serving as great complexes for human activity [see foldout map, pages 532-33]. We have also offered a solution to the traffic problem."

These ideas achieve spectacular life in a huge model (pages 530-1). Shortly, in the commission's office on — you guessed it — Pennsylvania Avenue, we were gazing down on it like gods upon the future.

The model's tree-lined Avenue — repaved with red brick, with a granite center strip, and with sidewalks set back — begins its journey like a river rising from a six-acre reflecting pool at the foot of Capitol Hill (page 507).

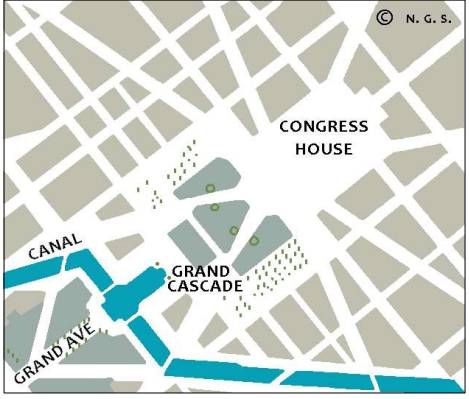
Flowing westward, the future Avenue approaches one of the major changes of the plan; it becomes a broad bridge over Constitution Avenue. At present, the two avenues and a street collide head on, dumping twenty lanes of traffic into a scissors intersection. The new overpass will allow the nearby National Gallery of Art to welcome patrons on a spacious plaza focused on the beautiful Mellon Fountain, now lost in an obscure little park.

At a point halfway between the Capitol and White House, the commission intends to rescue one of Major L'Enfant's basic ideas, now sadly mangled. Washington's first planner hoped to relieve the long diagonal of the Avenue by building a major structure on a hill overlooking a bustling marketplace. L'Enfant thought a church ought to go there.

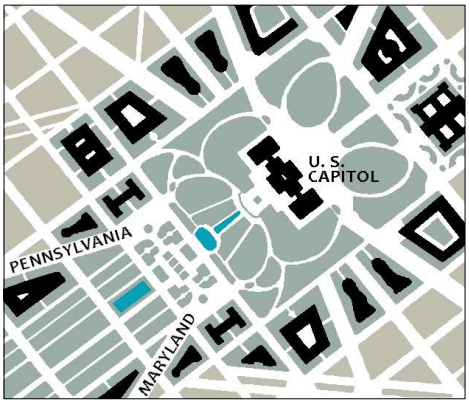
Unceremonial way, today's Pennsylvania Avenue seems choked with traffic in this telephoto-lens view from the site of the proposed National Square. Behind the bunting of national events, the Avenue's north side wears many drab 19th-century buildings.

The President's Temporary Commission on Pennsylvania Avenue has proposed diverting much of the traffic and lining the north side with "superblock" buildings, built above shopping arcades and parking garages.

Commission Chairman Nathaniel Owings describes the plan to author Judge (right), as they look down a rain-misted Avenue from the plaza of the Treasury building.



L'ENFANT PLAN OF 1791



McMILLAN PLAN OF 1902

Mirror for majesty, a six-acre reflecting pool (model far right) will provide a sparkling new beginning for Pennsylvania Avenue. At this site, between the arms of two imposing radial avenues, L'Enfant hoped to build a cascade flowing down Capitol Hill into Tiber Canal. By the time of the McMillan Plan in 1902 (left), the old canal had been filled in, but a large pool was proposed to reflect the Capitol. The Owings plan finally realizes this dream by building the pool above a tunneled freeway.

L'Enfant's grand geometry can still be seen in the baroque *patte d'oie*, or goose-foot intersection where Maryland Avenue, the Mall, and Pennsylvania Avenue come together at the foot of Capitol Hill (below). L'Enfant was born in 1754, son of a prominent French artist, and learned such landscape principles from places like the gardens of Versailles; despite constant change, Washington retains his graceful imprint.

Instead, our Patent Office occupied the hill; a modern Parthenon, it remains one of the city's most beautiful buildings. The market was torn down to make way for the National Archives, but between the two great buildings lies an assortment of business structures, in a district now largely outdated.

The Owings plan proposes clearing five blocks to reopen L'Enfant's axis. The National Portrait Gallery and National Collection of Fine Arts, now moving into the old Patent Office (page 508), would be reached by a mall stepping up between the buildings of a Woodrow Wilson Center for Scholars. Opposite the Archives, a new Market Square would resurrect the old bustle with shops and cafes.

Continuing between stepped promenades — grandstands for parade watching — the rose-colored Avenue would pass the new superblocks: great buildings with garden courts and elevated walkways.

Majestic Square for Nation's Pageantry

The plan reaches its climax in a National Square, framed by new White House gates and the Treasury. From an elevated belvedere to the north, where two hotels now stand, shoppers and diners would enjoy the wide vista, and spectators would watch parades wheeling around a splashing central fountain (painting, pages 510-11).

"Our plan is similar to an iceberg", Mr. Owings said. "Eighty percent of it is invisible. Much of the traffic will

JAMES P. BLAIR AND VICTOR R. BOSWELL, JR.; JAMES P. BLAIR (BELOW)

be channeled in tunnels, like E Street there. There will be underground parking for more than 20,000 cars.

"If we are serious about preserving the things that are important to us, like this priceless Avenue, then we must create the kind of environment we want and route traffic around it or under it. When this design is completed, we will have demonstrated that man and not the machine can he the dominant factor in our urban civilization."

The commission is optimistic about the plan's chances for survival, even in the Washington atmosphere of continuous controversy between independent agencies that relish the responsibility of the veto. The reflecting pool is being built. The Federal Bureau of Investigation will occupy one of the superblocks. Private developers are already erecting a new building in accordance with the over-all concept. And the plan has been approved by the National Capital Planning Commission and the Commission of Fine Arts, two stalwart guardians of the city's growth and appearance.

Slums Give Way to Tree-framed Towers

Grand as it is in scope, the Owings plan is only the centerpiece in a pattern of change covering all the central city (map, page 502).

To the north of the Avenue, a group of businessmen and planners, under the banner of "Downtown Progress", are seeking to revitalize the entire old business district.

To the south, the National Park Service — with Mr. Owings as consultant — is turning the sweeping green Mall into a lively park.

JAMES P. BLAIR © N.G.S.

America's family album, the new National Portrait Gallery occupies one of Washington's first public buildings, the old Patent Office, begun in 1836. Hard-hatted Director Charles Nagel guards a 1616 portrait of Indian princess Pocahontas, painted during her visit to King James I's court, while G. P. A. Healy's brooding Lincoln ponders the renovation of his historic surroundings. The neoclassic building, which will also house the National Collection of Fine Arts, would anchor the northern end of a proposed Eighth Street Mall opening from Market Square on Pennsylvania Avenue (see foldout map, page 533, key G1-H2).

South of the Mall, a stunning new Southwest is rising from the rubble of Washington's worst slum area.

Centered on Connecticut Avenue, south of Dupont Circle, a forest of private office buildings spreads toward the site of a proposed enclave for embassies. One of the Nation's most ambitious urban renewal programs is just getting started in the Shaw School area.

Foggy Bottom awaits completion of the John F. Kennedy Center for the Performing Arts (see foldout, page 532, key A5, No. 130). Congress has thrown the forward switch for central subway and freeway systems. And over the whole of it, the First Lady's Committee for a More Beautiful Capital — aided by a 13-member committee assembled by the District Commissioners — is making spring work overtime.

Let me rise immediately, adjust my boutonniere, and declare that as a loyal citizen I greeted the announcement of the First Lady's committee with incredulity. For nowhere else has nature seemed to bestow so many graces as upon flowering Washington.

Forsythia's Pale Gold Precedes Cherry Blossoms

The born and bred among us know when and where to look as March blows out on a gusty wind. The fragile flutes of white shadbush along the Potomac and happy cadenza of winter jasmine and forsythia at Dumbarton Oaks precede the major theme of pink-and-cream magnolias in Rawlins Park. By mid-April, blue and white hyacinths behind the White House and flowering quince at Hains Point join the daffodils of Rock Creek Park to introduce the sweeping major melody of Tidal Basin cherries.

Toward April's end, dogwood and redbud scatter lyric notes in every yard, azaleas and tulips come to full counterpoint, and the city's residential streets resemble an interlaced, endless garden of golden green leaves, emerald lawns, and shrubs of every hue.

More beautiful? Should Venus de Milo be 20 feet tall? I should also like to record that I was wrong. We had all thought too much about Chevy Chase yards and Georgetown gardens and not enough about other parts of the city. We had forgotten those tattered and bare little parks where no one goes and those desolate places beyond the marble buildings.

I remembered them on a ride with Miss Kathryn Simons, the imaginative National Park Service landscape architect who designs many of the projects for the First Lady's committee (page 518). We made our way into the northeast corner of the city where a narrow stream, Watts Branch, threads 19 bits and pieces of federal parkland. For years the faded neighborhood had used the valley as a convenient junk yard; refuse-laden waters trickled between muddy banks planted with old tires, broken bottles, and rusty cans.

Last year Laurance S. Rockefeller, a member of the First Lady's committee, selected a portion of this area for a $100,000 donation, and Miss Simons gave it verdant new life. It is the best example I know of how beauty can be wrung from urban wreckage.

When we arrived, a young mother, Mrs. Evelyn Humphrey, was sitting in the calm sunshine supervising her three small children. They were navigating a playground spaceship shaped like a huge oyster; our arrival caused a crash landing on the moon.

"Play equipment means as much as a pansy bed", Miss Simons said. "I often include it."

Grassy slopes that have replaced a graveyard of tin cans invited us to the water's edge, and big stepping stones beckoned us over. I felt like a kid again as we skipped across.

Miss Simons unfolded a map of Washington dashed and dotted in red ink. I learned that a growing number of private donations are helping to beautify my city — 10,000 azaleas, for example, one of many gifts of Mrs. Albert D. Lasker of New York City, will brighten Pennsylvania Avenue this spring. (Mrs. Lasker, I might add, heads the Society for a More Beautiful National Capital, Inc., a group that helps spark such gifts.) Hains Point will wear a pink-pearl necklace of 1,400 new flowering cherry trees from an anonymous donor, and a whole orchard of the famous Japanese beauties, a gift from Japan, is taking root on the Washington Monument grounds (foldout, key F4).

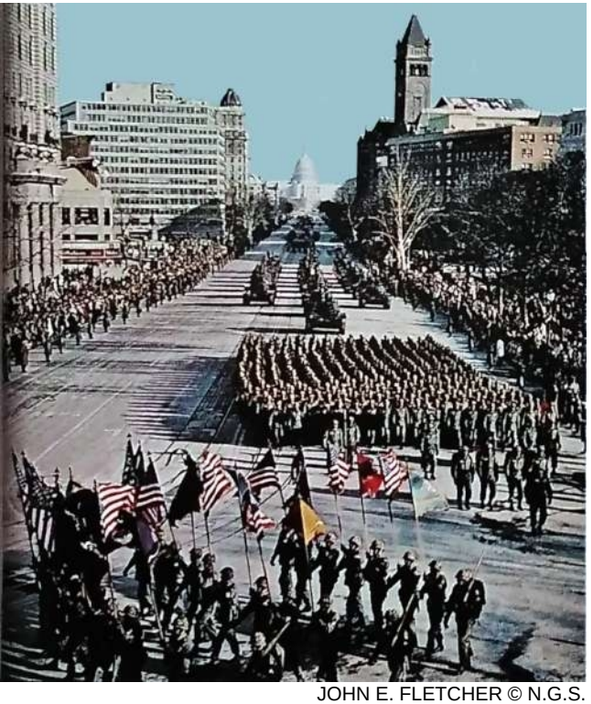
Last fall, the National Park Service and the District Government enriched Washington with 377,570 tulips, 274,390 daffodils, 93,344 other flowering plants, and a small forest of cherries, pines, willows, oaks, and maples. Not all will beautify well-known locales.

"You see these tiny places marked in red?" Kathy asked. "You find them where diagonal avenues cross the square grid of streets; Major L'Enfant gave them to us, and there are 376 of them. They let us add color and beauty where they are often most needed."

Her polished fingernail slid from Capitol Hill across the other Washington, that vast and featureless tundra of red-brown row houses stretching eastward like a three-dimensional shadow. It is the decaying home of 400,000 of the city's poorer residents and the first city of any kind that many of these residents, migrants from the rural South, have ever lived in.

JAMES P. BLAIR © N.G.S.; LIBRARY OF CONGRESS (BELOW)

History may find a new focus on National Square



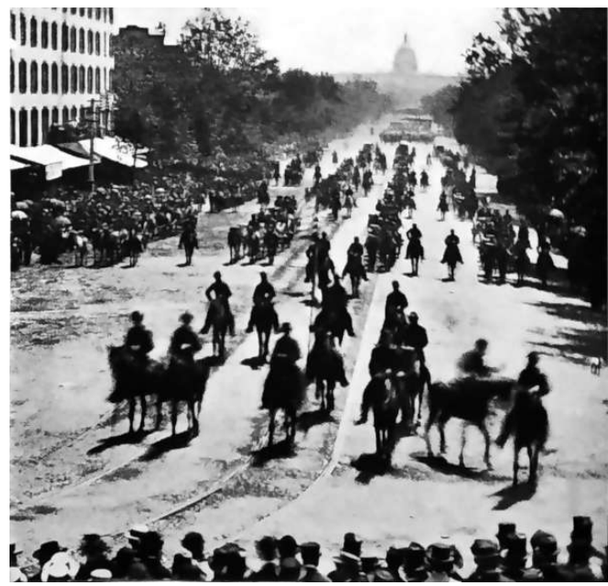
JOHN E. FLETCHER © N.G.S.

A VAST STAGE for spectacle, National Square as proposed by the President's Temporary Commission on Pennsylvania Avenue would provide a dramatic climax to the long sweep of the remodeled Avenue and a needed entrance court to the White House grounds.

Smaller than Paris's Place de la Concorde or Moscow's Red Square, Washington's National Square would measure 600 by 800 feet — "large enough", in the words of its originators, "to produce a sense of celebration". Massed troops, blaring bands, and flying colors of parades, such as the Kennedy Inaugural (left) or the triumphant two-day passage of the victorious Union armies in 1865 (right), would find the square a majestic setting for display and Presidential review. A maze of intersections and two large hotels now occupy the site of the square, outlined in white on the aerial photograph at upper right.

Architect Owings, chairman of the Pennsylvania Avenue commission, foresees important everyday uses for the square as well. The 6,000 persons who now visit the White House on an average day would make it a gathering place, finding shops, restaurants, and umbrella-shaded cafes rimming the great central plaza. To the north, on a natural rise of 20 feet, would stand a belvedere, a tree-shaded overlook offering a fine view. Beneath the square, E and 14th Streets would funnel cars to underground parking garages in the heart of the redeveloped business district.

Thus the commission envisions the square, free of cars, as a meeting ground for tourists, shoppers, and residents. To show how the square might look, Washington artist Lily Spandorf has placed a building similar to the National Geographic Society's new 17th Street headquarters at the corner of 14th Street and Pennsylvania Avenue.



JAMES P. BLAIR © N.G.S.

Harbingers of change

OUR NATION'S wide front lawn, the Mall, has been a planner's battleground for years. A reeking canal on the site of present Constitution Avenue once separated the Mall from the young city; later, a cindery railroad track carried steam engines across it to the foot of Capitol Hill. In 1902, a distinguished panel — the McMillan Commission — presented a Mall plan that led back toward L'Enfant's grand scheme. Eliminating the railroad and lining the sweeping greensward with monumental buildings, the commission extended the Mall to the Lincoln Memorial and set aside East and West Potomac Parks.

We spent a long afternoon drifting up and down those old blocks, all wearing the same weary face. Even the shadows seemed a tired gray. Yet here and there a sudden show of early flowers, an oasis of benches and trees, a bright puzzle of play equipment snapped out of the drab background. One of the program's slogans — "Masses of flowers for passing masses of people" — seemed to me more appropriate for Fifth Avenue's Easter Parade, but here in east Washington I learned something about the punch of a single blossom.

I asked Kathy who selected the chips of city for improvement.

"Many times Mrs. Johnson herself does it, during a 'broken-window tour'", she said. "You should go on one."

Next morning I hunted up Mr. Walter Washington, who since has become New York City's director of public housing. When I talked to him, he headed the National Capital Housing Authority and conducted Mrs. Johnson's frequent tours of the city. The warming sun was climbing as I entered the old building near the White House, but upstairs it was a bad day for Mr. Washington. Phones were ringing with news of a fire in a public-housing unit; a small child was dead.

"A three-year-old was playing with matches", he told me with a grim face.

His assistant, Mrs. Virginia Harris, brought coffee in paper cups, and we gathered over a model of a playground. Toy figures smaller than a fingernail were enjoying a never-ending summer, splashing in a shallow pool, crossing a little desert of sand, spying out passages in a stone pyramid.

"When this program started", Mr. Washington said, "there were some, I suppose, who regarded it as Marie Antoinette's piece of cake. I mean, out in east Washington, how many rats can you kill with a tulip? But it hasn't been that way at all. We started with mass plantings, then we moved on to Project Pride, and now we are here." He pointed down at the model as his phone buzzed.

Mrs. Harris told me that during Project Pride, a cleanup, fix-up campaign in a poor neighborhood financed by the beautification program, the residents had hauled away 163 truckloads of trash and baited rats over an 86-block area. Vacant lots had turned into play areas and gardens. The model before us showed a playground for the Buchanan School in Southeast to be presented to the City by the Vincent Astor Foundation of New York.

Beautification Helps to End Vandalism

"That was Mrs. Johnson on the phone", said Mr. Washington. "We're going for a tour". He looked at me and smiled: "I didn't plan it this way".

In my car, Mrs. Harris and I hurried out to Park View School, where we thought Mrs. Johnson might stop, and found it badly in need of beautification. Every window had several missing panes; the pounded earth of the yards held scarcely a blade of grass.

"How often does Mrs. Johnson go out like this?" I asked.

"Frequently. It's an amazing fact that in poor areas like this one, beautification of schools has cut down vandalism. Mrs. Johnson knows just about every street and alley in this city. Sometimes she takes a station wagon, and sometimes she takes… that!"

A black limousine blurred by us. I screeched away from the curb in pursuit.

"What if the Secret Service shoots at us?"

"Just follow along behind", Mrs. Harris said.

brighten the Mall

Today's proposals, drawn by the firm of Skidmore, Owings & Merrill as consultant to Secretary Udall, envision a bright new life for the proud but empty space. Acres of trees would shelter kiosks, restaurants, even carrousels like that tried out last summer by the Smithsonian Institution. Summer evenings would be spangled with *Son et Lumière* — sound and light — bringing the city's history alive. Sightseers would shuttle about on small trackless trains that, when tried experimentally (below, right), proved the most popular rides in town.

VICTOR R. BOSWELL, JR. (ABOVE); JAMES P. BLAIR © N.G.S.

We sailed along for a block or two, and I wondered how anybody could see much at that clip. We finally came to a red light, and I swooped in behind the quarry.

"She's in disguise!" I exclaimed.

We peered into the small rear window. Wrong car! A happy bride turned and smiled at us. Flushed and foolish, I turned into a side street.

For the rest of the day, you might say that the First Lady of the United States and I went to different schools together. We visited the Buchanan School, where real little boys were playing in a barren yard. We followed South Capitol Street's broad swath between slum and redevelopment areas. Once, I think, we even caught a glimpse of each other as we sped determinedly in different directions. Since we both had engagements for dinner, she went back to the White House, and I joined a traffic jam on Constitution Avenue.

Evening had fallen on the eastern city behind me, but up ahead the Mall stretched like the very image of order toward a river still molten with sunset. It seemed absurd to think it, but the scene before me was destined for a higher grandeur. Secretary of the Interior Stewart L. Udall intends to give the Mall an exciting new public role. The National Park Service is already experimenting with tourist trains to shuttle visitors to museums and monuments.

One morning I joined a group waiting for such a train at the memorial to Gen. George G. Meade, who led the Union troops at Gettysburg.

"Just think", said an elderly woman gazing up at the statuary, "my great-grandfather fought under that man."

"Well", said her friend, "his feet didn't hurt any worse than mine do now."

The "minitrain" with its canopied trailer came cruising along. With that peculiar form of embarrassment that only a native can know when disguised as a tourist, I went aboard, dropped in a dime, and sat down.

"Where are *you* from?" one of the ladies asked. A catalogue of towns flashed through my mind — Sheboygan, Scituate, Ashtabula.

"I was born here", I said in a low voice.

She stared at me quietly and curiously before turning to her companion again.

"My", said the woman, "this certainly is a big, beautiful open place, isn't it? What are they doing up there?"

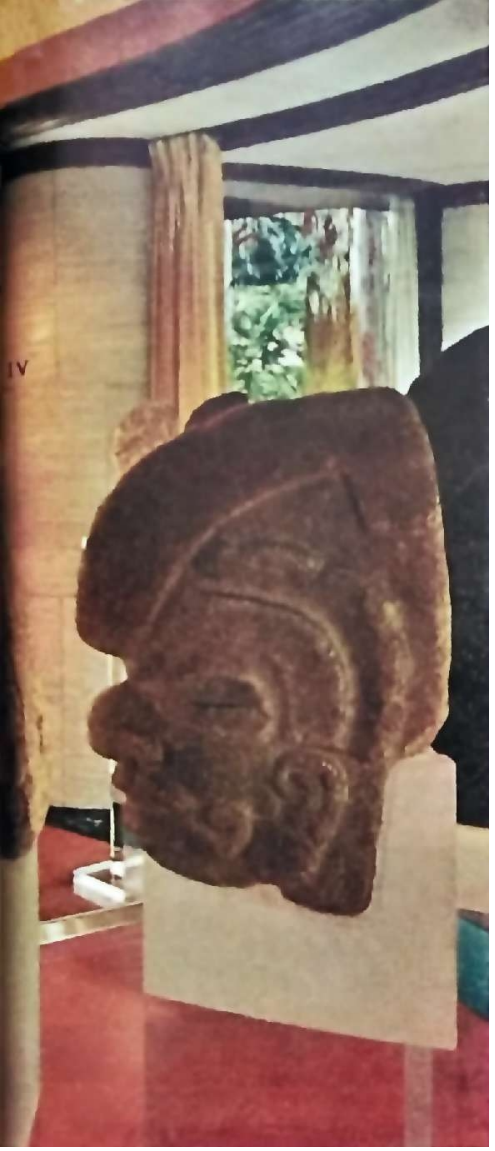
We were approaching a fence behind which construction cranes arched their stiff necks.

"They are putting Ninth Street underground", I volunteered. "Twelfth is already under, and eventually most streets that cross the Mall will be tunneled or eliminated. In that open square opposite the Archives, there will be a sculpture garden."

"This man was *born* here", she said to her friend. The other one put on her glasses and examined a stain on my trousers.

"You would think", she said, "you people would learn to tunnel along like a gopher without digging the whole place up. After all, this *is* the Nation's Capital."

The poor old Mall. I could not help thinking that it has been nothing but torn up through most of its existence. Early travelers described it as a desolate forest broken only by the marshy meander of Tiber, or Goose, Creek. When the city fathers, dreaming of commerce, linked



Artistic showcase for art houses the distinguished pre-Columbian collection of Robert Woods Bliss at Dumbarton Oaks. Architect Philip Johnson interlocked eight gracefully domed galleries of marble, bronze, and glass around a central pool. Windows open onto the natural glories of a group of public gardens. Now part of Harvard University as a center for Byzantine studies, Dumbarton Oaks has long been a haven for flower-lovers. Miss Judy Schaffer (below) matches her fair beauty with the first herald of spring, Dumbarton's winter jasmine, often mistaken for the forsythia that follows it.

JAMES P. BLAIR (BELOW) AND B. ANTHONY STEWARD © N.G.S.

Tiber and James Creeks into a canal between the Potomac and Anacostia Rivers in 1815, they divided the Mall from the young village.

In 1848 the Washington Monument began to rise on the Mall, but soon stopped for lack of funds. Its stub remained on the hill, ringed by shacks and mud, for many years.

Iron Horses Chuffed Across the Mall

At mid-century, the Mall enjoyed a pleasant interlude with Andrew Jackson Downing's romantic English park and the building of the Smithsonian Institution by the Gothic-revival architect, James Renwick. The feudal pile of red sandstone — today the Smithsonian's administrative headquarters — mastered the Mall like an ancient keep behind the moat of Tiber Canal, until the Civil War turned the area into an armed camp.

In 1872, the Pennsylvania Railroad opened a branch line across the Mall, bringing the chuffing iron horse, with its sooty breath, to a place where L'Enfant had envisioned the homes of foreign ambassadors and flower-decked walks. An unsightly station rose where the National Gallery of Art now stands. Begun in a bog, the heart of the Nation's Capital became a clutter of railroad yards.

The city was not embarrassed about its lack of splendor until it celebrated its hundredth birthday in 1900. An angry American Institute of Architects called attention to the deplorable fate of the city's plans; the following year, Senator James McMillan of Michigan, a leading member of the District Committee, formed a commission that brought together two distinguished architects — Daniel H. Burnham and Charles F. McKim — and Frederick Law Olmsted, Jr., a well-known landscape architect. The noted sculptor Augustus Saint-Gaudens joined them later.

The McMillan Commission planned the city we know today, even though their ideas were long in coming to fruition. They framed the Mall with marble buildings, extended it to the Lincoln Memorial, set aside East and West Potomac Parks, and rescued L'Enfant's faltering design (diagrams, page 506).*

Before presenting its plan, the commission made a grand tour of European capitals to study "parks in their relations to public buildings". They admired the grandeur of Versailles, walked along the Bois de Boulogne, and swept through Hyde Park. While in London, Mr. Burnham — who later was to design Washington's stately Union Station — met Alexander J. Cassatt, president of the Pennsylvania Railroad and brother of artist Mary Cassatt. Impressed by the commission's ideas, Mr. Cassatt agreed to remove his tracks and station from the Mall. I thought how much nicer my quiet little train was than his big noisy ones.

At the Lincoln Memorial I bade goodbye to the shuttle and started back down the Mall, trying to recall when last I had walked it. Never! I had never walked the entire length of the Mall. What a comforting thought for a native son, when others rely on that tired old boast of never having climbed the Washington Monument.

It was one of the most refreshing walks of my life — cast away on a large island of rolling grass and calling crows, soothed by the splash of fountains at the reflecting pool, lulled by the wander of an unseasonably soft wind. Government workers, momentarily releasedfrom their paper servitude, breathed in the gentle air and stretched out on the grass.

* William Howard Taft described these early efforts in "Washington, Its Beginning, Its Growth, and Its Future", GEOGRAPHIC, March, 1915.

Spring's full glory crowns the National Arboretum's Mount Hamilton, where 60,000 azaleas and flowering dogwoods smother the wooded hillsides with color. Louis J. Halle,

The time is drawing near when they will be joined by countless others. If the National Park Service plans are carried out, visitors will find a pedestrian paradise dotted with kiosks, restaurants, carrousels, and foot paths. The entire area from the Capitol to the Lincoln Memorial will be laced by trackless trains running slowly on rubber tires.

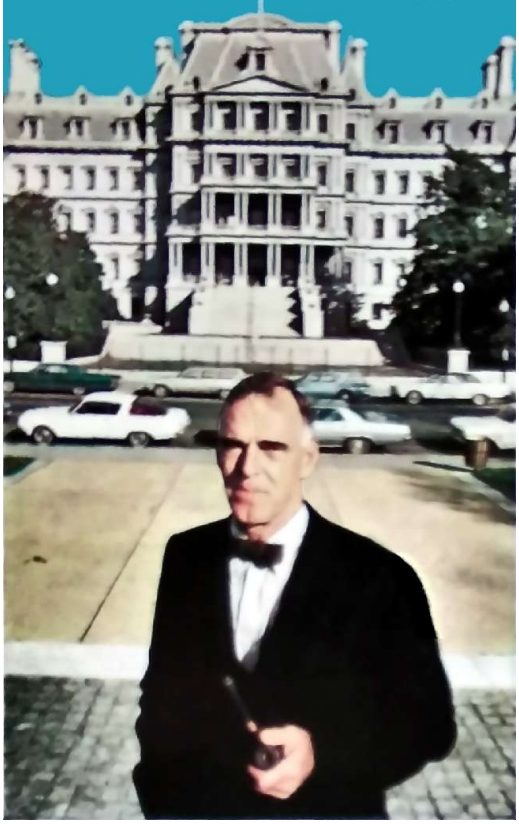
Best Blooms Wait Until Tourists Depart

While the long axis will retain its formality of trees planted in orderly rows and low terraced squares plumed by fountains, the section that scatters out toward the Tidal Basin will be even more in the image of American informality than it is today — a natural parkland framing blue waters (pages 530-1).The lure was too much to resist, and I turned that way. (There! I have still never walked the entire length of the Mall.) I was soon wandering amid the still-bare Yoshino cherry trees — a single-flowering variety ringing the Tidal Basin — that are the living symbol of spring in Washington. The loveliest blooms come later, though; about two weeks after the tourists go home, the double-blossomed Kwanzans of East Potomac Park break forth in clouds of deep pink.

I looked out over the Tidal Basin from Kutz Bridge, warmed by the knowledge that it will be eliminated; the south leg of the city's new inner-loop freeway, rather than smashing through these gentle green acres, will run *under* both the Lincoln Memorial grounds and the Tidal Basin, to emerge in the new Southwest (see foldout, pages 532-33, keys C6-H5, and transportation map, page 534).

author of *Spring in Washington*, said of such a scene: "A man from Mars might have stopped passers-by to inquire in what god's celebration the city was so garlanded."

B. ANTHONY STEWART © N.G.S.



JAMES P. BLAIR © N.G.S.

Gulls skidded on a rising wind over the Washington Channel as I came out from under the shadow of the Southwest Freeway and looked upon a landscape as strange to me as Oz. The sturdy fishing boats that for years have sold succulent oysters and fat fish from Chesapeake Bay were still moored along the wharf—but the old fish markets, restaurants, and boys playing tambourines were gone. Beyond lay the new Southwest, much of it empty lots where slums had stood, but much of it risen, a glass-winged phoenix, from the ashes of the past.

New brick town houses kept a discreet distance from a church resembling a stack of rockets. A low and rambling shopping center cowered in the glare of glass from sophisticated apartment towers.

Just ahead I was startled to see a gang of bearded men rushing with drawn swords toward a helpless coffee vendor. I hastened to report the imminent murder and bumped into Mr. Thomas Fichandler. He laughed and said, "That's Macbeth taking a coffee break".

I had known Tom since the days when he and his dynamic wife Zelda founded Arena Stage, now a world-famous repertory theater. Their first company had played in an abandoned motion-picture theater so crammed with bleacherlike seats that the actors literally had to run around the block to make their entrances from the other side of the stage.

We entered a splendid building designed for theater-in-the-round, the first new legitimate theater built in Washington since 1895.

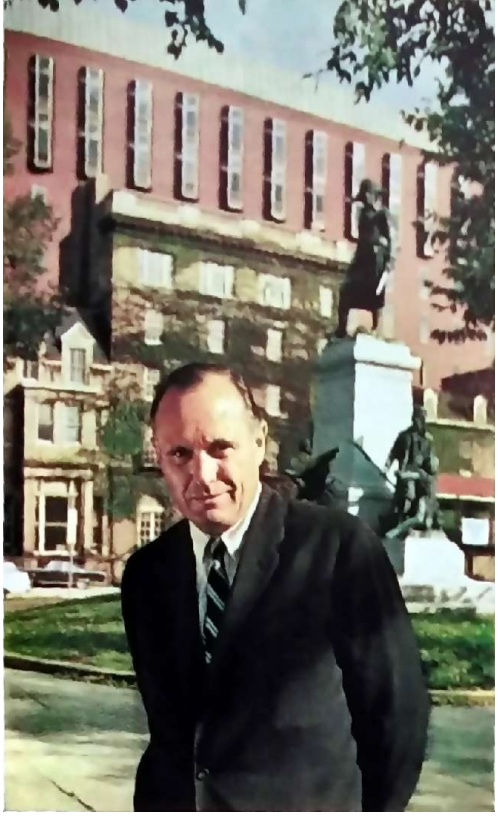
"I know what you're thinking", Tom said, "but believe me, staging a good play is as difficult as ever. We do like it here in the Southwest, though. Its problem at the moment is becoming a community, but that is also the problem of Washington, isn't it?"

We made our way through the costume room, bulging with leather jerkins and spiked helmets, negotiated a carpentry shop where Birnam Wood was growing, and looked out on a lot where Arena will add a wing.

Earliest Row Houses Still Stand

From the world of Macbeth, I followed the greatly altered riverfront, yearning for the scent of terrapin soup spiked with sherry. Seven apartment towers footed with town houses now crowd down to the river (pages 522-3). Making my way through them, I found the Federal City's oldest row houses wearing a new coat of sunshine.

Mr. Edward Dent, manager of Harbour Square apartments, was testing a new lock.



JOSEPH J. SCHERSCHEL © N.G.S.

"The architect, Chloethiel Woodard Smith, carefully integrated these old houses into the development", he told me. "In a way the city of Washington started with these bricks."

I knew the story, and it ran through my mind as we stepped into the restored elegance of Wheat Row, erected in 1795. George Washington had marked off the site for the new Federal City five years before. Local property owners agreed to sell half their land to the young government at a modest price, in the belief that rising values on what they kept would soon compensate them handsomely. But by 1793, when James Greenleaf appeared with a letter of introduction from George Washington, the infant city was foundering. Public auction of lots had gone dismally, and little construction was underway in the "silent wilderness".

Greenleaf formed a syndicate with Robert Morris, America's wealthiest man, and John Nicholson, Morris's partner in speculation. They purchased 6,000 lots from the city and acquired an additional 1,200 from private owners, hoping to pledge the property against a substantial loan from Dutch bankers. The company agreed to build 20 houses each year for seven years; Greenleaf set about building the four houses of Wheat Row.

Many hands mold a new Washington

THE NATION'S CAPITAL, one of the world's few planned cities, challenges architects with many pitfalls. Yet the pace of change quickens under the guidance of creators such as these:

Nicholas Satterlee, standing before the old State, War, and Navy Building — now housing White House executive offices — will renovate the gently scorned but much-loved Victorian granite pile.

Miss Kathryn Simons, National Park Service landscape architect, shows her design for the triangle along "Embassy Row" honoring Irish patriot Robert Emmet. More than 700 parks dot the city; many have blossomed through efforts of the First Lady's Committee for a More Beautiful Capital.

John Carl Warnecke, before Kosciusko's statue, was called upon to save Lafayette Square's façade of historic buildings, marked for destruction, and still make room for giant federal buildings. He accomplished it by setting the new structures back and screening them with the older houses.

Mrs. Chloethiel Woodard Smith, a guiding spirit in the design of the new Southwest and the "Ponte Vecchio" bridge (page 536), stands beneath the welcoming sign to another admired project, the new F Street Plaza.

JAMES P. BLAIR © N.G.S.

Like an ocean liner, the German Embassy's new Chancery west of Georgetown has outside decks on every floor and six levels that step down on either side. Architect Egon Eiermann used German windows and floors and Oregon pine that gives the interior a warm orange glow. Lebanon, Kuwait, the Netherlands, Switzerland, Denmark, Iran, and Yugoslavia have also given international flavor to Washington's building boom.

We paused in a bare sitting room. The wind blew up and whined at the window panes. The absolute quiet of the house brought back Greenleaf's end. With France's invasion of the Dutch Republic, the prospect of the loan vanished forever. Members of the overextended syndicate, bickering among themselves, were ruined. By 1798 all three were in debtor's prison in Philadelphia, where Nicholson died. Bankruptcy proceedings freed Morris to a life of destitution after three and a half years. Greenleaf, released in less than a year, returned to Washington to while away his days amid "the worthless paper".

Some distinguished tenants live in the handsome H-shaped block of towers behind Wheat Row, among them Vice President and Mrs. Hubert H. Humphrey, who moved there last fall. Mr. Dent and I climbed to the rooftop and stepped out into the sky.

We could trace the silver river downstream as far as the new Woodrow Wilson Memorial Bridge at Alexandria, Virginia. Directly before us, a jet thundered aloft from National Airport. To our right, monumental Washington lay like a living postcard. One of the most prominent features of the landscape was the mammoth foundation for the Defense Department's James Forrestal Building, already known as the Little Pentagon.

"That is where the new Tenth Street Mall is going to be", Mr. Dent said. He pointed in the direction of a herd of cranes, trucks, and cement mixers browsing on a 30-acre field of concrete and steel girders.

The street will be widened to 150 feet and will enter the Southwest under the Forrestal Building, then come toward the water down a mall about half a mile long to a large overlook (page 536). Buses will take visitors from there across the channel on an 874-foot bridge holding more than 100 shops and restaurants, and then on to the new $10,000,000 aquarium.

"All of it should be completed", said Mr. Dent, "— including the aquarium — by 1969."

I tried to recall the teeming warren of shacks that I knew as the Southwest. Old Dixon's

Democracy's shrine, the National Archives guards the Declaration of Independence, the Constitution, and the Bill of Rights. John Russell Pope designed the building, opened in 1935, as part of the Federal Triangle, the epitome of monumental Washington. Mother at right, like so many Washington tourists, photographs her children holding a target from the Federal Bureau of Investigation's indoor practice range a block away.

Court was the largest inhabited alley in the city; when the D. C. Redevelopment Land Agency started knocking the Southwest down in 1954, they found that two-thirds of the houses had no central heating and half had no inside plumbing. The worst slum of all enjoyed a splendid close-up view of the Capitol (page 522).

Critics contend that the alley dwellers only ended up in other alleys. I ended up at a sidewalk cafe on Pennsylvania Avenue — one of the city's present total of 27 — where both the awning and the prices were up.

Sidewalk cafe? *Mais oui!* After a few hesitant moments of trying to hide behind the potted hedge, I began to feel dangerously continental. Gay Jacques Judge! *Vive le nouveau Washington!* A young lady was gliding along the Avenue, and I tossed her a jaunty wink. What fools progress makes of us all. I ate meekly and paid the check with a feeling I had been born too late.

I walked up the hill and was soon lost in a forest that had somehow sprung up in the middle of plain old F Street (page 519).

Where once street cars had clanged their way through throngs of shoppers, 13 pin oaks — 40 feet tall! — and 40 red maples seemed to have grown overnight. Granite benches, red kiosks, special telephone booths rode a brick island stretching two blocks.

I found Mr. Melvin Levine and Mr. Robert Morris in the offices of the National Capital Downtown Committee, Inc., on 12th Street, studying an immense model of Washington between the White House and the Capitol.

"With the cooperation of public agencies and private businessmen, this committee is trying to bring the interior of the city back to life. Those two blocks are a demonstration of a public space redesigned for people", Mr. Levine told me. "Shoppers are returning to the city. Sales are picking up again. Did you know F Street before?"

"Sure", I said. "I was born here."

"You were *born* here?"

JOSEPH J. SCHERSCHEL © N.G.S.; JACK LARTZ, WASHINGTON POST

Once the worst slum in the city, the Southwest now wears a rich mantle of apartments near the Washington Channel. Residents of Harbour Square, above, gather in a roof garden as lights come on in the Tiber Island and Town Center projects behind.

Only 14 years ago, the Statue of Freedom atop the Capitol overlooked a vastly different scene, where faded and decaying houses huddled in squalor. This famous photograph helped spur the drive to rebuild the area; today the D. C. Redevelopment Land Agency, moving into other old sections, will emphasize rehabilitation rather than wholesale demolition and family displacement.

During the years of my youth, all Washington shopped on F Street. “Going downtown” was a thrilling event. Will I ever forget seeing *Robin Hood* at the old Palace and, in later years, finding out what “sauerbraten” meant at the small rathskeller on 11th Street?

Farmland Engulfed by Urban Tide

In those days a man could drive in 15 minutes out of the midst of one million people, most of them occupying 68,500 urbanized acres, into the open country. He would find himself on the flowing farmland of Maryland or Virginia, with forests of tulip trees and oak, crops and blue-green pastures.

By 1960, there were more than two million people in the Washington area, the amount of urbanized land had exploded to 326,062 acres, and 500,000 acres of farmland had been paved with houses. This frantic, roaring suburban tide was draining from the central city its higher-income families and thus its commercial vitality.

“Sure”, Mr. Levine said, “Washington was worried. In 1962 our committee drew up an Action Plan. What the Pennsylvania Avenue project is doing complements ours. The traffic patterns work together. The Federal Government provided most of the funds for the F Street Plaza, and the District’s Highway Department carried out the plan. We think downtown Washington is going to come alive again. Take a look at the store downstairs. Not even its developers dreamed it would be the success it is.”

Quest for Pete’s Ends in a Lobby

I immediately went down to Safeway International, which specializes in foreign and gourmet foods. Wending my way between *escargots au naturel* and towers of caviar, I turned left at the *djintan* and *sambal radja* — Indonesian spice specialities — and stopped near the whole suckling pigs ($30.20, not including the apple for the mouth). There, by gorry, stood a fellow native, stunned by the spectacle of a mound of feathered pheasants. I pounded him on the back and suggested that we seek out the old rathskeller. *He* suggested we might buy half a pound of Gruyère cheese and a crusty loaf of French bread and languish under the trees on F Street.

But I was not that ready for the new Washington. Leaving the instant woodland behind, I headed for Foggy Bottom and an oasis called Pete’s, one of the city’s truly historic landmarks that once catered to cab drivers and Cabinet officers. I suspected that Pete’s had gone the way of the gasworks next door, but I was convinced that in this city of new amenity, of flowering boulevards, happy cafes, and petunia-laden parks, something similar to the old place would be offered the harried urbanite.

I hoped in vain. Foggy Bottom lay in the coils of a freeway. It had made the riverside simply a place to go through.

I walked into the outdoor lobby of the new Watergate East, a sweeping cliff of apartments that now dominates the Potomac, and watched waters of a stream leaping down a ladder of white concrete saucers.

Mid-city haven of Farragut Square entices office workers from nearby buildings, many erected in the past five years. Tulips, azaleas, and flowering crab apples frame a statue of

"May I help you, sir?" asked a doorman.

"I was looking for Pete's", I mumbled.

"Pardon me, sir?"

Stirred from my reverie, I said, "I am so sorry. I was looking for Peter's establishment, but I believe he has removed."

Behind Watergate East, at the foot of a grassy slope, machines were lumbering around in a great hole that will be the John F. Kennedy Center for the Performing Arts. As I made my way around it, I could not imagine a performance ever being quite as big as the building, which will hold a theater, an opera house, and a symphony hall.

One act has already taken place, however, which this reviewer applauds. Local school children have painted sections of the construction fence; the pictures are happy and lively and real. It is a colorful gesture of welcome to the great things that lie ahead.

Good old riverbank. I dragged my weary feet toward the Potomac and flattened out under one of the willows. The most graceful creatures in town, these willows announce the arrival of spring as it crosses the river on a warm southern wind.

In the dusk, cars were streaming with impassive headlights along the George Washington Memorial Parkway on the Virginia shore. From the gloom of Arlington National Cemetery's hill, the blue flame at President Kennedy's grave licked against the falling dark. The Custis-Lee Mansion's ghostly columns rose from the long sleep of history.

Not even Arlington will escape the city's transformation. Its narrow roads swamped with automobiles, its verdant hill cordoned off for continuous lines of visitors, the cemetery was preparing to install a large underground parking lot and make other arrangements to preserve the dignity of the hallowed place. But now it rested. The old quiet returned, and I knew that not far upstream on the Potomac, toward Great Falls, deer would be coming down through the woods to drink.

B. ANTONY STEWART © N.G.S.

naval hero David Glasgow Farragut, famed for his remark, “Damn the torpedoes!” during the battle of Mobile Bay in 1864. In summer and fall, other flowers replace the tulips.

From the air, much of the city is hidden by trees. It is, in fact, the rugged wooded shores of the Potomac, the vast forested wedge of Rock Creek Park, and the 250,000 street trees that give my city its aura of peace and beauty.

However, one event that is certain to change both the pace and character of Washington is the decision of the last Congress to move ahead on subway and highway construction. Subway engineers already had a test shaft sunk through Lafayette Square opposite the White House.

“Boss” Shepherd Built Modern City

On the way there, I skirted Pershing Square to watch a crop of Mrs. Johnson’s bulbs being planted. Across 14th Street, Alexander Shepherd’s fat statue stood upon his pedestal.

How “Boss” Shepherd would have loved Washington today, with streets full of concrete mixers, the sky alive with cranes and scaffolds, and an exhilarating air of confidence and controversy everywhere. He invented that environment.

In 1871 the city finally wrested from Congress a territorial form of government uniting the Federal City, Georgetown, and the County of Washington. President Grant signed the bill while a two-day carnival celebrated the paving of 17 blocks of Pennsylvania Avenue, unfortunately with wood.

Alexander R. Shepherd, a Washington native and a political crony of President Grant, controlled the new Board of Public Works and immediately embarked upon a program of civic improvement. Conditions in the city were deplorable. There were no sewers, except the scum-coated canals, and other streets were neither paved nor graded. Geese, chickens, and cows roamed at large; one Washingtonian returned home from church to find a 400-pound hog sleeping on his sofa.

For the sum total of $4,358,598, Mr. Shepherd announced — and “without one dollar of increased tax” — the board could undertake his “scheme of municipal redemption”. His plan hit the city like an atomic bomb. Within three years, Shepherd’s crews had laid 208 miles of

sidewalk and 157 miles of roads. They laid 120 miles of sewers, filled in the old Tiber Canal, and planted thousands of trees.

They began everywhere at once, so that nearly every street in the entire city was torn up at the same time. Dazed natives found their houses hanging 20 feet in the air over their former front stoop, or left so low by the grading they had to enter by a second-story window. Worst of all, the city — with a basic annual revenue of only $1,500,000 — spent $20,000,000 in three years and went broke.

Enraged, inconvenienced, muddy, and bankrupt, the Capital lost the reins of government to Congress, which established a three-member commission to straighten out "the mess in Washington". It has helped govern us, with or without that slogan, ever since.

The statue of a fat and aging Shepherd is a slander. He was in his thirties when he knocked the town down and built it up again.

I hurried over to a Shepherdesque scene in Lafayette Square, where ominous thumps, bumps, and sizzles sounded from inside a low fence.

Cody Pfanstiehl, community-relations official for the National Capital Transportation Agency, greeted me with an aluminum hard hat. We went through the fence and peered down a deep shaft. Seven stories below us, a dim lantern shone on a foaming pond the size of a postage stamp.

JAMES P. BLAIR © N.G.S.

Umbrellas bloomed along with blossoms when the District Commissioners permitted sidewalk cafes five years ago. Now 27 restaurants, such as Chez François on Connecticut Avenue, greet their patrons with outside tables, hedges, and awnings.

25-mile Subway Begun

We started down a ladder of boards nailed to beams along the side of the test pit. The leaves and swooping pigeons of the square waved goodbye. Mr. Pfanstiehl's voice issued hollowly from the darkness.

"This whole thing started seven years ago", he said. "In 1959 the Mass Transportation Survey called for 329 miles of highways and 33 miles of rail transportation… Watch the platform".

At 40 feet down we rested, while Cody opened a trap door in the wall. "See that? We're still in clay here. No ground water coming through."

We legged over a wooden railing and started down again, climbing into a mist and then into a gentle spray. The wooden rung had acquired a brown icing of cold mud.

"When we issued our plan in 1962", he continued, "we asked for fewer highways and more rail. Then the fight began."

“Pride is catching”

THAT REMARK, made by a school principal after a cleanup campaign, has become a motto. Student David Evans accepted a White House award for the beautification program of his school, Walker-Jones. Volunteers in the District’s Youth Gardens project tend a neighborhood playground. Officials have found that beautification, creating pride, helps reduce vandalism.

KEN FIRESTONE; JAMES R. HOLLAND © N.G.S. (TOP)

It was raining underground. Drops were playing random cymbals on my hat.

“Some people thought that highways would pulverize established neighborhoods and spread blight. Others thought subways cost too much. Anyway, the fight is over. This city is embarking on the biggest single public-works program in its history — 25 miles of railway and 29 stations [map, page 534]. After seven years, here we are!”

Splash!

The pit had narrowed to four by six feet of gurgling water. A lone workman hunched in a yellow poncho handed Cody a greasy lump of gray matter.

“Schistose-gneiss!” Cody said triumphantly. “It’s almost like granite — just the thing to put a subway on.”

City Readies for the Future

I had one last stop on my long road into Washington’s future. There was a slight chill and a leafy tang in the air as I left home; one could tell that spring would soon be stirring — surely the most glorious spring of them all.

On this morning, my road lay elsewhere than to the Phillips gallery or the old canal. I had been invited into the Southeast to a beautification project — the kind that results from the First Lady’s “broken-window tours”.

The Stanton Dwellings, a fading public-housing project on Alabama Avenue, seemed asleep under gray skies. Then a blast of music almost took me off my feet. Around the corner, in a dreary central court, a party was going on. A host of Negro children scurried about with long brooms in the wake of a trash truck and sweeper. John Staggers, a dynamic man in a red sweatshirt who taught sociology at Howard University before joining Walter Washington's staff, was standing at a microphone. Two loudspeakers thundered with the pounding rhythms of popular music.

"Good morning, good morning! Come out and join the team! This is a *big* day…"

Indeed it was going to be a big day. Sleepy-eyed residents of the Stanton Dwellings cracked their doors and peered out at their sons and daughters twisting with brooms.

Mr. Staggers, a relentless cheerleader, soon had a pep rally of some sixty people sweeping and cleaning and policing the grounds. The rally became a rolling parade as trucks, teen-agers, and trumpets proceeded from court to court, gathering recruits and refuse as it went.

Cleanup Time Becomes Party Time

I put my broom down, wiped my brow, and cornered Mr. Staggers.

"We're going to have a hot-dog roast at two o'clock", he said, "and later this evening a neighborhood dance for the teen-agers and the adults. We are interested in the beautification program; we are also interested in helping the people here find a sense of community. Washington has a chance to become a truly great city, inside and out. The cleanup makes a wonderful occasion for the party, and that

Friends fishing on the banks of the Anacostia River rest in the shade of flowering crab apples.

Concerned about their city, most Washingtonians agree with naturalist Roger Tory Peterson's view that "if the environment is shabby, the thinking and the impulses of statesmanship will become shabby".

Friends walking enjoy the Tidal Basin's canopy of cherry blossoms. Future Washington, a grander Capital than ever, will also seek to preserve its small-scale charm.

BRUCE DALE (ABOVE); B. ANTONY STEWART © N.G.S.

makes a nice occasion for the neighborhood. A neighborhood that cares can help lift itself. That's beautification, isn't it?"

I agreed that it might be the best kind. A little girl in a bright red dress was walking at that moment across the court, leading an elderly man who was partially blind. She was carrying a bent pie plate. I leaned down and asked her how old she was.

"Three", she said.

Her grandfather chuckled. "I been trying to get her to throw this junk out", he said. "My name is Arthur Young".

I reached out and found his hand and shook it.

"How long have you lived in Washington, Mr. Young?" I asked him.

"All my life".

"So have I", I said. "I went by to see my first home, and it's just not there any more".

"Neither is mine".

"Well, maybe it will work out very well for us natives", I said.

"I hope so".

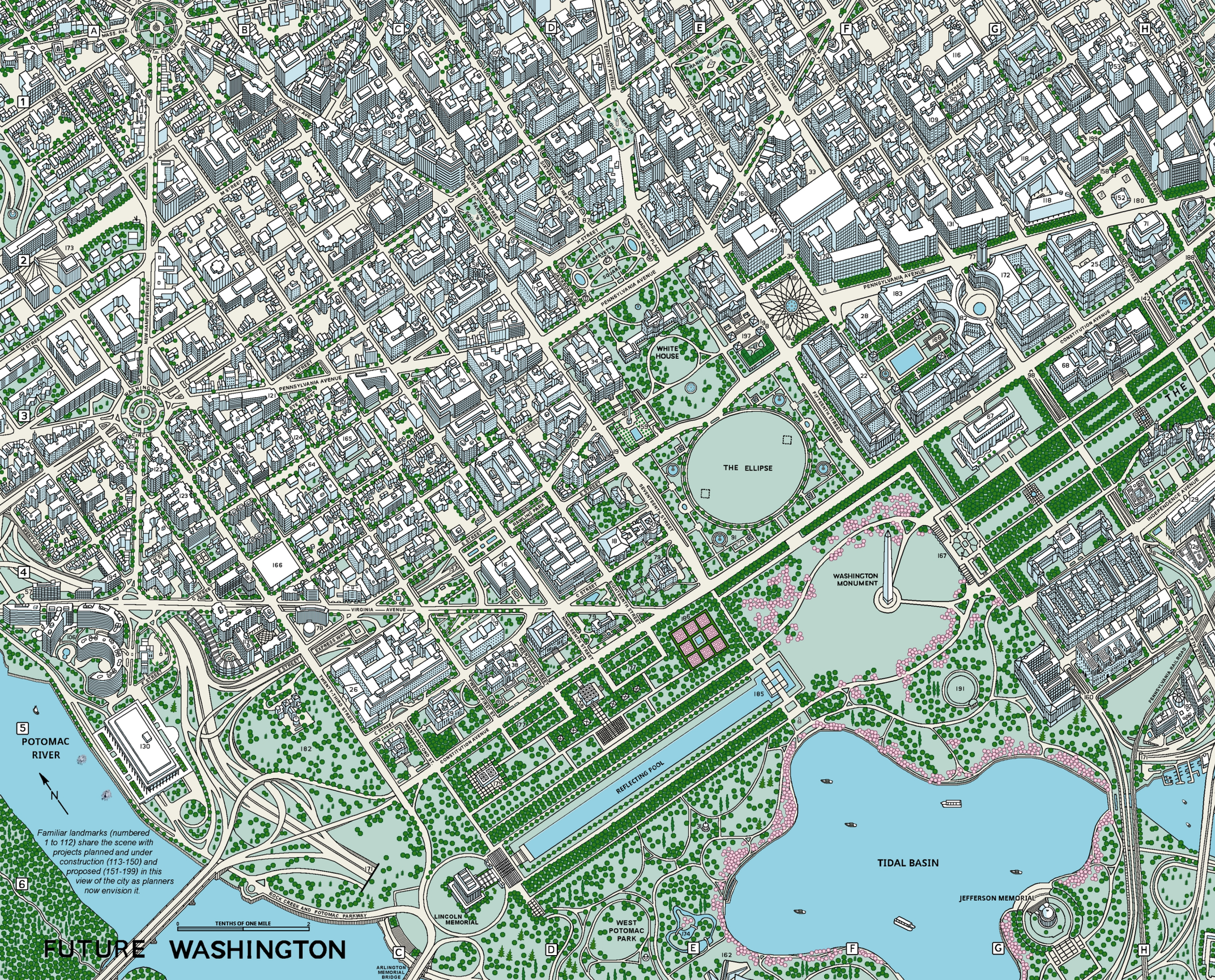
The record hop was about to begin, and by this time almost a thousand people had converged on the band of beautifiers. I could not stay, so I said goodbye and drove back.

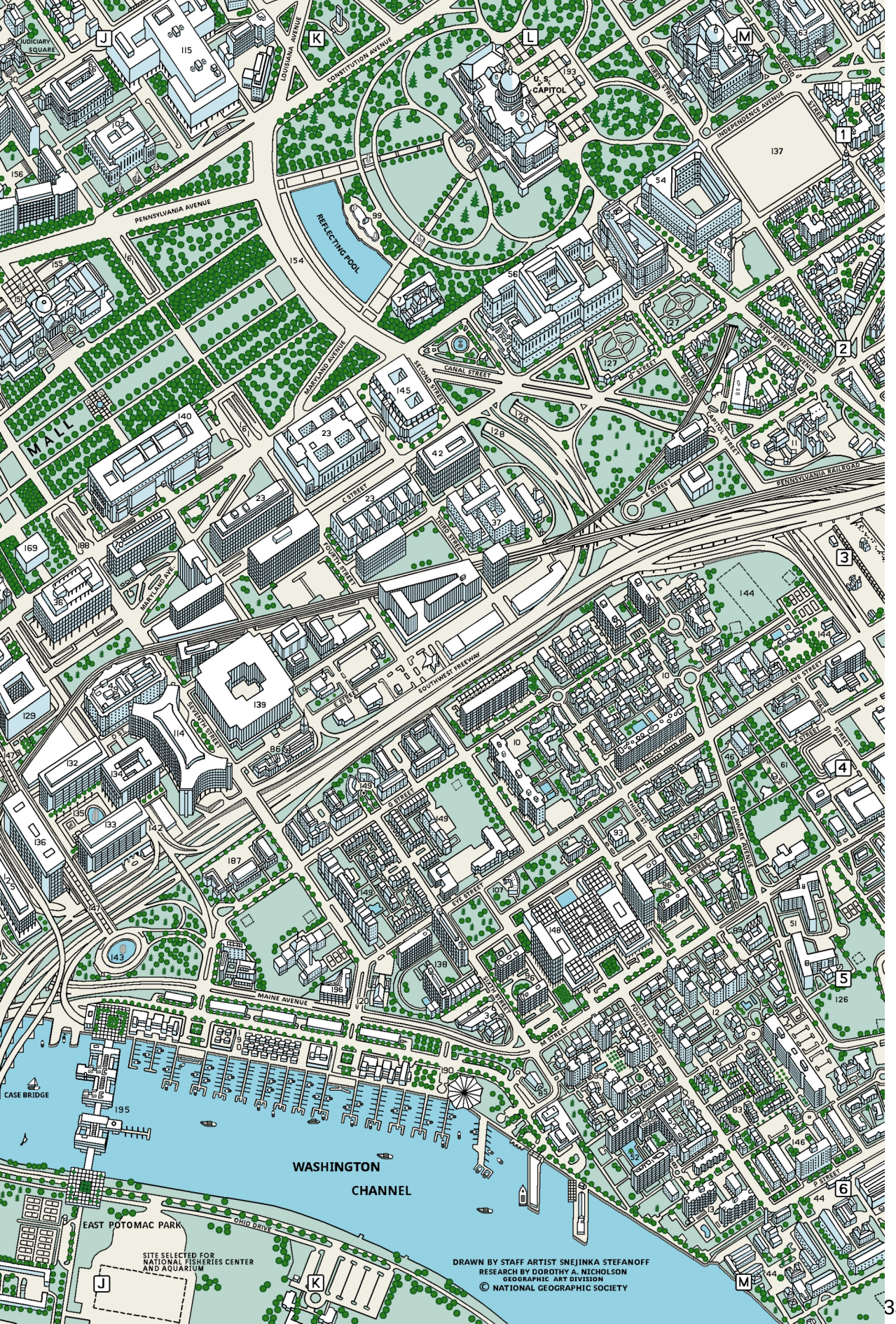
The white dome of the Capitol, like the hopes of the Nation, rose serene and strong from gathering mist as I approached. Around its flank, the magnificent Mall spread out toward the Washington Monument and Lincoln Memorial. I thought how different the scene would appear to my sons in their time as our city, drawn by a dream of glory, driven by dread of the ghetto, struggled to be both great and good.

THE END

Band of dedicated beautifiers led by Mrs. Lyndon B. Johnson gathers in the State Dining Room of the White House to hear architect Nathaniel A. Owings, with pointer, describe his plans for transforming Pennsylvania Avenue and the Mall. His model, retaining L'Enfant's basic design, dramatically portrays the Avenue's broad sweep to National Square, and the verdant Mall as a haven for pedestrians. Traffic from the suburbs would flow downtown through tunnels beneath the Mall and the square. One freeway, dipping under the Tidal Basin, would make possible the removal of a present-day bridge. Huge underground parking garages would be scattered through the heart of the city to

accommodate more than 20,000 cars. (See foldout map, pages 532-33, and transportation map, page 534.) Secretary of the Interior Stewart L. Udall, beside Mr. Owings, leads efforts to purify and protect the Potomac River and landscape a redeveloped Mall. Others at the meeting of the First Lady's Committee for a More Beautiful Capital include, left to right: businessman Knox Banner; Presidential Advisor Charles A. Horsky; National Capital Planning Commission Chairman Mrs. James H. Rowe, Jr.; Mrs. Robert S. McNamara; State Department official Mrs. Katie Louchheim; businessman C. William Martin, Jr.; philanthropist Laurance S. Rockefeller; and architect John M. Woodbridge, in rear.


FUTURE WASHINGTON
Familiar landmarks (numbered 1 to 112) share the scene with projects planned and under construction (113-150) and proposed (151-199) in this view of the city as planners now envision it.
TENTHS OF ONE MILE
WHITE HOUSE
THE ELLIPSE
WASHINGTON MONUMENT
TIDAL BASIN
REFLECTING POOL
LINCOLN MEMORIAL
JEFFERSON MEMORIAL
WEST POTOMAC PARK
POTOMAC RIVER
ARLINGTON MEMORIAL BRIDGE
ROCK CREEK AND POTOMAC PARKWAY
PENNSYLVANIA AVENUE
CONSTITUTION AVENUE
INDEPENDENCE AVENUE
VIRGINIA AVENUE
MASS. AVE.
NEW HAMPSHIRE AVENUE
VERMONT AVENUE
MADISON PLACE
JACKSON PLACE
LAFAYETTE SQUARE
FRANKLIN SQUARE
MCPHERSON SQUARE
SCOTT CIRCLE
DUPONT CIRCLE
THOMAS CIRCLE
MASSACHUSETTS AVENUE
CONNECTICUT AVENUE
RHODE ISLAND AVENUE
K STREET
L STREET
M STREET
N STREET
O STREET
P STREET
Q STREET
E STREET
F STREET
G STREET
H STREET
I STREET
J STREET
FIFTEENTH STREET
FOURTEENTH STREET
THIRTEENTH STREET
TWELFTH STREET
ELEVENTH STREET
TENTH STREET
NINTH STREET
SEVENTH STREET
SIXTH STREET
FIFTH STREET
FOURTH STREET
THIRD STREET
SECOND STREET
FIRST STREET
NORTH CAPITOL STREET
WASHINGTON CIRCLE
CRESCENT PLACE
RAWLINS PARK
HENRY BACON DRIVE
ADAMS MEMORIAL
FREER GALLERY
HIRSHHORN MUSEUM
SMITHSONIAN INSTITUTION
FREEDOM PLAZA
PERSHING PARK
MADISON BUILDING
HOUSE OFFICE BUILDING
THE
PENNSYLVANIA RAILROAD


JUDICIARY SQUARE
J
K
L
M
LOUISIANA AVENUE
CONSTITUTION AVENUE
U. S. CAPITOL
FIRST STREET
SECOND STREET
INDEPENDENCE AVENUE
PENNSYLVANIA AVENUE
REFLECTING POOL
MALL
MARYLAND AVENUE
SECOND STREET
CANAL STREET
NEW JERSEY AVENUE
D STREET
SOUTH CAPITOL STREET
PENNSYLVANIA RAILROAD
C STREET
HURD STREET
FOURTH STREET
SOUTHWEST FREEWAY
SEVENTH STREET
E STREET
F STREET
G STREET
H STREET
I STREET
K STREET
L STREET
M STREET
P STREET
6TH STREET
7TH STREET
9TH STREET
10TH STREET
11TH STREET
12TH STREET
13TH STREET
14TH STREET
15TH STREET
16TH STREET
17TH STREET
18TH STREET
19TH STREET
20TH STREET
21ST STREET
22ND STREET
23RD STREET
24TH STREET
25TH STREET
26TH STREET
27TH STREET
28TH STREET
29TH STREET
30TH STREET
31ST STREET
32ND STREET
33RD STREET
34TH STREET
35TH STREET
36TH STREET
37TH STREET
38TH STREET
39TH STREET
40TH STREET
41ST STREET
42ND STREET
43RD STREET
44TH STREET
45TH STREET
46TH STREET
47TH STREET
48TH STREET
49TH STREET
50TH STREET
51ST STREET
52ND STREET
53RD STREET
54TH STREET
55TH STREET
56TH STREET
57TH STREET
58TH STREET
59TH STREET
60TH STREET
61ST STREET
62ND STREET
63RD STREET
64TH STREET
65TH STREET
66TH STREET
67TH STREET
68TH STREET
69TH STREET
70TH STREET
71ST STREET
72ND STREET
73RD STREET
74TH STREET
75TH STREET
76TH STREET
77TH STREET
78TH STREET
79TH STREET
80TH STREET
81ST STREET
82ND STREET
83RD STREET
84TH STREET
85TH STREET
86TH STREET
87TH STREET
88TH STREET
89TH STREET
90TH STREET
91ST STREET
92ND STREET
93RD STREET
94TH STREET
95TH STREET
96TH STREET
97TH STREET
98TH STREET
99TH STREET
100TH STREET
101ST STREET
102ND STREET
103RD STREET
104TH STREET
105TH STREET
106TH STREET
107TH STREET
108TH STREET
109TH STREET
110TH STREET
111TH STREET
112TH STREET
113TH STREET
114TH STREET
115TH STREET
116TH STREET
117TH STREET
118TH STREET
119TH STREET
120TH STREET
121ST STREET
122ND STREET
123RD STREET
124TH STREET
125TH STREET
126TH STREET
127TH STREET
128TH STREET
129TH STREET
130TH STREET
131ST STREET
132ND STREET
133RD STREET
134TH STREET
135TH STREET
136TH STREET
137TH STREET
138TH STREET
139TH STREET
140TH STREET
141ST STREET
142ND STREET
143RD STREET
144TH STREET
145TH STREET
146TH STREET
147TH STREET
148TH STREET
149TH STREET
150TH STREET
151ST STREET
152ND STREET
153RD STREET
154TH STREET
155TH STREET
156TH STREET
157TH STREET
158TH STREET
159TH STREET
160TH STREET
161ST STREET
162ND STREET
163RD STREET
164TH STREET
165TH STREET
166TH STREET
167TH STREET
168TH STREET
169TH STREET
170TH STREET
171ST STREET
172ND STREET
173RD STREET
174TH STREET
175TH STREET
176TH STREET
177TH STREET
178TH STREET
179TH STREET
180TH STREET
181ST STREET
182ND STREET
183RD STREET
184TH STREET
185TH STREET
186TH STREET
187TH STREET
188TH STREET
189TH STREET
190TH STREET
191ST STREET
192ND STREET
193RD STREET
194TH STREET
195TH STREET
196TH STREET
197TH STREET
198TH STREET
199TH STREET
200TH STREET
201ST STREET
202ND STREET
203RD STREET
204TH STREET
205TH STREET
206TH STREET
207TH STREET
208TH STREET
209TH STREET
210TH STREET
211TH STREET
212TH STREET
213TH STREET
214TH STREET
215TH STREET
216TH STREET
217TH STREET
218TH STREET
219TH STREET
220TH STREET
221ST STREET
222ND STREET
223RD STREET
224TH STREET
225TH STREET
226TH STREET
227TH STREET
228TH STREET
229TH STREET
230TH STREET
231ST STREET
232ND STREET
233RD STREET
234TH STREET
235TH STREET
236TH STREET
237TH STREET
238TH STREET
239TH STREET
240TH STREET
241ST STREET
242ND STREET
243RD STREET
244TH STREET
245TH STREET
246TH STREET
247TH STREET
248TH STREET
249TH STREET
250TH STREET
251ST STREET
252ND STREET
253RD STREET
254TH STREET
255TH STREET
256TH STREET
257TH STREET
258TH STREET
259TH STREET
260TH STREET
261ST STREET
262ND STREET
263RD STREET
264TH STREET
265TH STREET
266TH STREET
267TH STREET
268TH STREET
269TH STREET
270TH STREET
271ST STREET
272ND STREET
273RD STREET
274TH STREET
275TH STREET
276TH STREET
277TH STREET
278TH STREET
279TH STREET
280TH STREET
281ST STREET
282ND STREET
283RD STREET
284TH STREET
285TH STREET
286TH STREET
287TH STREET
288TH STREET
289TH STREET
290TH STREET
291ST STREET
292ND STREET
293RD STREET
294TH STREET
295TH STREET
296TH STREET
297TH STREET
298TH STREET
299TH STREET
300TH STREET
301ST STREET
302ND STREET
303RD STREET
304TH STREET
305TH STREET
306TH STREET
307TH STREET
308TH STREET
309TH STREET
310TH STREET
311TH STREET
312TH STREET
313TH STREET
314TH STREET
315TH STREET
316TH STREET
317TH STREET
318TH STREET
319TH STREET
320TH STREET
321ST STREET
322ND STREET
323RD STREET
324TH STREET
325TH STREET
326TH STREET
327TH STREET
328TH STREET
329TH STREET
330TH STREET
331ST STREET
332ND STREET
333RD STREET
334TH STREET
335TH STREET
336TH STREET
337TH STREET
338TH STREET
339TH STREET
340TH STREET
341ST STREET
342ND STREET
343RD STREET
344TH STREET
345TH STREET
346TH STREET
347TH STREET
348TH STREET
349TH STREET
350TH STREET
351ST STREET
352ND STREET
353RD STREET
354TH STREET
355TH STREET
356TH STREET
357TH STREET
358TH STREET
359TH STREET
360TH STREET
361ST STREET
362ND STREET
363RD STREET
364TH STREET
365TH STREET
366TH STREET
367TH STREET
368TH STREET
369TH STREET
370TH STREET
371ST STREET
372ND STREET
373RD STREET
374TH STREET
375TH STREET
376TH STREET
377TH STREET
378TH STREET
379TH STREET
380TH STREET
381ST STREET
382ND STREET
383RD STREET
384TH STREET
385TH STREET
386TH STREET
387TH STREET
388TH STREET
389TH STREET
390TH STREET
391ST STREET
392ND STREET
393RD STREET
394TH STREET
395TH STREET
396TH STREET
397TH STREET
398TH STREET
399TH STREET
400TH STREET
401ST STREET
402ND STREET
403RD STREET
404TH STREET
405TH STREET
406TH STREET
407TH STREET
408TH STREET
409TH STREET
410TH STREET
411TH STREET
412TH STREET
413TH STREET
414TH STREET
415TH STREET
416TH STREET
417TH STREET
418TH STREET
419TH STREET
420TH STREET
421ST STREET
422ND STREET
423RD STREET
424TH STREET
425TH STREET
426TH STREET
427TH STREET
428TH STREET
429TH STREET
430TH STREET
431ST STREET
432ND STREET
433RD STREET
434TH STREET
435TH STREET
436TH STREET
437TH STREET
438TH STREET
439TH STREET
440TH STREET
441ST STREET
442ND STREET
443RD STREET
444TH STREET
445TH STREET
446TH STREET
447TH STREET
448TH STREET
449TH STREET
450TH STREET
451ST STREET
452ND STREET
453RD STREET
454TH STREET
455TH STREET
456TH STREET
457TH STREET
458TH STREET
459TH STREET
460TH STREET
461ST STREET
462ND STREET
463RD STREET
464TH STREET
465TH STREET
466TH STREET
467TH STREET
468TH STREET
469TH STREET
470TH STREET
471ST STREET
472ND STREET
473RD STREET
474TH STREET
475TH STREET
476TH STREET
477TH STREET
478TH STREET
479TH STREET
480TH STREET
481ST STREET
482ND STREET
483RD STREET
484TH STREET
485TH STREET
486TH STREET
487TH STREET
488TH STREET
489TH STREET
490TH STREET
491ST STREET
492ND STREET
493RD STREET
494TH STREET
495TH STREET
496TH STREET
497TH STREET
498TH STREET
499TH STREET
500TH STREET
501ST STREET
502ND STREET
503RD STREET
504TH STREET
505TH STREET
506TH STREET
507TH STREET
508TH STREET
509TH STREET
510TH STREET
511TH STREET
512TH STREET
513TH STREET
514TH STREET
515TH STREET
516TH STREET
517TH STREET
518TH STREET
519TH STREET
520TH STREET
521ST STREET
522ND STREET
523RD STREET
524TH STREET
525TH STREET
526TH STREET
527TH STREET
528TH STREET
529TH STREET
530TH STREET
531ST STREET
532ND STREET
533RD STREET
534TH STREET
535TH STREET
536TH STREET
537TH STREET
538TH STREET
539TH STREET
540TH STREET
541ST STREET
542ND STREET
543RD STREET
544TH STREET
545TH STREET
546TH STREET
547TH STREET
548TH STREET
549TH STREET
550TH STREET
551ST STREET
552ND STREET
553RD STREET
554TH STREET
555TH STREET
556TH STREET
557TH STREET
558TH STREET
559TH STREET
560TH STREET
561ST STREET
562ND STREET
563RD STREET
564TH STREET
565TH STREET
566TH STREET
567TH STREET
568TH STREET
569TH STREET
570TH STREET
571ST STREET
572ND STREET
573RD STREET
574TH STREET
575TH STREET
576TH STREET
577TH STREET
578TH STREET
579TH STREET
580TH STREET
581ST STREET
582ND STREET
583RD STREET
584TH STREET
585TH STREET
586TH STREET
587TH STREET
588TH STREET
589TH STREET
590TH STREET
591ST STREET
592ND STREET
593RD STREET
594TH STREET
595TH STREET
596TH STREET
597TH STREET
598TH STREET
599TH STREET
600TH STREET
601ST STREET
602ND STREET
603RD STREET
604TH STREET
605TH STREET
606TH STREET
607TH STREET
608TH STREET
609TH STREET
610TH STREET
611TH STREET
612TH STREET
613TH STREET
614TH STREET
615TH STREET
616TH STREET
617TH STREET
618TH STREET
619TH STREET
620TH STREET
621ST STREET
622ND STREET
623RD STREET
624TH STREET
625TH STREET
626TH STREET
627TH STREET
628TH STREET
629TH STREET
630TH STREET
631ST STREET
632ND STREET
633RD STREET
634TH STREET
635TH STREET
636TH STREET
637TH STREET
638TH STREET
639TH STREET
640TH STREET
641ST STREET
642ND STREET
643RD STREET
644TH STREET
645TH STREET
646TH STREET
647TH STREET
648TH STREET
649TH STREET
650TH STREET
651ST STREET
652ND STREET
653RD STREET
654TH STREET
655TH STREET
656TH STREET
657TH STREET
658TH STREET
659TH STREET
660TH STREET
661ST STREET
662ND STREET
663RD STREET
664TH STREET
665TH STREET
666TH STREET
667TH STREET
668TH STREET
669TH STREET
670TH STREET
671ST STREET
672ND STREET
673RD STREET
674TH STREET
675TH STREET
676TH STREET
677TH STREET
678TH STREET
679TH STREET
680TH STREET
681ST STREET
682ND STREET
683RD STREET
684TH STREET
685TH STREET
686TH STREET
687TH STREET
688TH STREET
689TH STREET
690TH STREET
691ST STREET
692ND STREET
693RD STREET
694TH STREET
695TH STREET
696TH STREET
697TH STREET
698TH STREET
699TH STREET
700TH STREET
701ST STREET
702ND STREET
703RD STREET
704TH STREET
705TH STREET
706TH STREET
707TH STREET
708TH STREET
709TH STREET
710TH STREET
711TH STREET
712TH STREET
713TH STREET
714TH STREET
715TH STREET
716TH STREET
717TH STREET
718TH STREET
719TH STREET
720TH STREET
721ST STREET
722ND STREET
723RD STREET
724TH STREET
725TH STREET
726TH STREET
727TH STREET
728TH STREET
729TH STREET
730TH STREET
731ST STREET
732ND STREET
733RD STREET
734TH STREET
735TH STREET
736TH STREET
737TH STREET
738TH STREET
739TH STREET
740TH STREET
741ST STREET
742ND STREET
743RD STREET
744TH STREET
745TH STREET
746TH STREET
747TH STREET
748TH STREET
749TH STREET
750TH STREET
751ST STREET
752ND STREET
753RD STREET
754TH STREET
755TH STREET
756TH STREET
757TH STREET
758TH STREET
759TH STREET
760TH STREET
761ST STREET
762ND STREET
763RD STREET
764TH STREET
765TH STREET
766TH STREET
767TH STREET
768TH STREET
769TH STREET
770TH STREET
771ST STREET
772ND STREET
773RD STREET
774TH STREET
775TH STREET
776TH STREET
777TH STREET
778TH STREET
779TH STREET
780TH STREET
781ST STREET
782ND STREET
783RD STREET
784TH STREET
785TH STREET
786TH STREET
787TH STREET
788TH STREET
789TH STREET
790TH STREET
791ST STREET
792ND STREET
793RD STREET
794TH STREET
795TH STREET
796TH STREET
797TH STREET
798TH STREET
799TH STREET
800TH STREET
801ST STREET
802ND STREET
803RD STREET
804TH STREET
805TH STREET
806TH STREET
807TH STREET
808TH STREET
809TH STREET
810TH STREET
811TH STREET
812TH STREET
813TH STREET
814TH STREET
815TH STREET
816TH STREET
817TH STREET
818TH STREET
819TH STREET
820TH STREET
821ST STREET
822ND STREET
823RD STREET
824TH STREET
825TH STREET
826TH STREET
827TH STREET
828TH STREET
829TH STREET
830TH STREET
831ST STREET
832ND STREET
833RD STREET
834TH STREET
835TH STREET
836TH STREET
837TH STREET
838TH STREET
839TH STREET
840TH STREET
841ST STREET
842ND STREET
843RD STREET
844TH STREET
845TH STREET
846TH STREET
847TH STREET
848TH STREET
849TH STREET
850TH STREET
851ST STREET
852ND STREET
853RD STREET
854TH STREET
855TH STREET
856TH STREET
857TH STREET
858TH STREET
859TH STREET
860TH STREET
861ST STREET
862ND STREET
863RD STREET
864TH STREET
865TH STREET
866TH STREET
867TH STREET
868TH STREET
869TH STREET
870TH STREET
871ST STREET
872ND STREET
873RD STREET
874TH STREET
875TH STREET
876TH STREET
877TH STREET
878TH STREET
879TH STREET
880TH STREET
881ST STREET
882ND STREET
883RD STREET
884TH STREET
885TH STREET
886TH STREET
887TH STREET
888TH STREET
889TH STREET
890TH STREET
891ST STREET
892ND STREET
893RD STREET
894TH STREET
895TH STREET
896TH STREET
897TH STREET
898TH STREET
899TH STREET
900TH STREET
901ST STREET
902ND STREET
903RD STREET
904TH STREET
905TH STREET
906TH STREET
907TH STREET
908TH STREET
909TH STREET
910TH STREET
911TH STREET
912TH STREET
913TH STREET
914TH STREET
915TH STREET
916TH STREET
917TH STREET
918TH STREET
919TH STREET
920TH STREET
921ST STREET
922ND STREET
923RD STREET
924TH STREET
925TH STREET
926TH STREET
927TH STREET
928TH STREET
929TH STREET
930TH STREET
931ST STREET
932ND STREET
933RD STREET
934TH STREET
935TH STREET
936TH STREET
937TH STREET
938TH STREET
939TH STREET
940TH STREET
941ST STREET
942ND STREET
943RD STREET
944TH STREET
945TH STREET
946TH STREET
947TH STREET
948TH STREET
949TH STREET
950TH STREET
951ST STREET
952ND STREET
953RD STREET
954TH STREET
955TH STREET
956TH STREET
957TH STREET
958TH STREET
959TH STREET
960TH STREET
961ST STREET
962ND STREET
963RD STREET
964TH STREET
965TH STREET
966TH STREET
967TH STREET
968TH STREET
969TH STREET
970TH STREET
971ST STREET
972ND STREET
973RD STREET
974TH STREET
975TH STREET
976TH STREET
977TH STREET
978TH STREET
979TH STREET
980TH STREET
981ST STREET
982ND STREET
983RD STREET
984TH STREET
985TH STREET
986TH STREET
987TH STREET
988TH STREET
989TH STREET
990TH STREET
991ST STREET
992ND STREET
993RD STREET
994TH STREET
995TH STREET
996TH STREET
997TH STREET
998TH STREET
999TH STREET
1000TH STREET
1
2
3
4
5
6
CASE BRIDGE
MAINE AVENUE
WASHINGTON
CHANNEL
EAST POTOMAC PARK
OHIO DRIVE
SITE SELECTED FOR NATIONAL FISHERIES CENTER AND AQUARIUM
DRAWN BY STAFF ARTIST SNEJINKA STEFANOFF
RESEARCH BY DOROTHY A. NICHOLSON
GEOGRAPHIC ART DIVISION
© NATIONAL GEOGRAPHIC SOCIETY

The Capital's grand design

"MAKE NO LITTLE plans; they have no magic to stir men's blood", said architect Daniel Burnham, a member of the 1901 McMillan Commission. Today men dream once again of a more beautiful and worthy Capital. The foldout map on the three preceding pages captures their plans and aspirations. To create it, NATIONAL GEOGRAPHIC staff members gleaned details from 251 low-level aerial photographs made for the purpose. They studied the Owings model for Pennsylvania Avenue and the Mall (pages 530-1) and the plans of federal agencies. They spotted construction sites and surveyed architects' blueprints for future projects. Existing features on the map bear numbers 1-112, those planned or under construction, 113-150, and those proposed, 151-199.

Grand vistas stretch from the domed Capitol across a new reflecting pool, now being built at the foot of Capitol Hill. The Mall, reaching to the Potomac, appears as it will look when stripped of the last of the temporary buildings erected during the two world wars, and planted with thousands of additional trees. Traffic that now crosses the Mall will flow underground. A hodgepodge of present commercial buildings has vanished from the north side of Pennsylvania Avenue, giving way to superblocks creating a truly ceremonial approach to National Square — today the site of the Willard and Washington Hotels and a tangle of intersections. Midway down the Avenue, the proposed Market Square opens in front of the National Archives. Beside it stands the future Federal Bureau of Investigation headquarters and a proposed Center for Scholars, memorializing Woodrow Wilson. Farther down the Avenue, toward the White House, the map shows the Federal Triangle as it will look when the old Post Office Building has been razed, except for its stately tower, and a cluttered parking lot has become a Grand Plaza.

South of the Mall, between Independence Avenue and the Southwest Freeway, small parks and open courts of the future give breathing room to new federal buildings. In the Southwest Urban Renewal Area, apartment complexes, town houses, and a shopping center already spread toward the Washington Channel. Eventually, a marina will offer moorings for boats, and the planned "Ponte Vecchio" bridge, clustered with shops, will lead to East Potomac Park and its new aquarium. On the banks of the Potomac, the John F. Kennedy Center for the Performing Arts — now only a hole in the ground — is shown completed.

Freeways are planned to sweep past the Kennedy Center and dip underground near the Lincoln Memorial. Cars will meet the sun again beyond 14th Street, permitting removal of the unsightly bridge marring the Tidal Basin. Thus, pedestrians will inherit the greensward of West Potomac Park as well as the redeveloped Mall.

Map below shows how freeways, tunnels, subways, and underground parking lots will free the Capital of the future from traffic's choking grip — a major objective of the Owings plan.

KEY TO FOLDOUT MAP

EXISTING

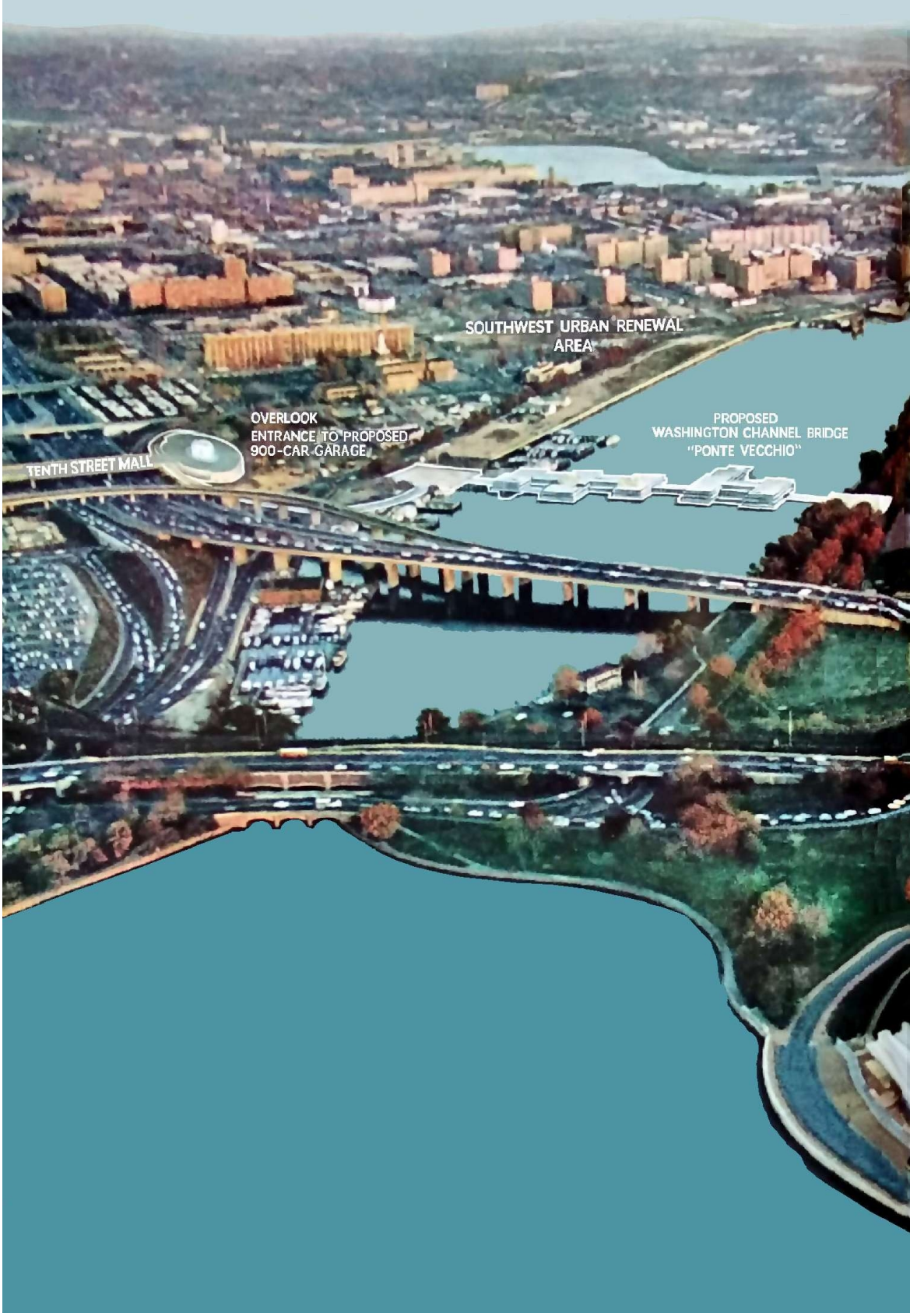
1 AMERICAN PHARMACEUTICAL ASSOCIATION....C5
2 AMERICAN RED CROSS....D4
3 ARENA STAGE....L5
4 ARTS AND INDUSTRIES BUILDING....H3
5 BETHEL PENTECOSTAL TABERNACLE....M4
6 BLAIR HOUSE....D2
7 BOTANIC GARDEN....K2
8 BUREAU OF ENGRAVING AND PRINTING....G5, H5
9 BUREAU OF INDIAN AFFAIRS....D4
10 CAPITOL PARK (APARTMENTS AND TOWN HOUSES)...L4, M4
11 CAPITOL POWER PLANT....M2
12 CARROLLSBURG SQUARE....M5
13 CHALK HOUSE WEST....M6
14 CHRIST METHODIST CHURCH....L4
15 CHURCH OF SAINT STEPHEN MARTYR....A3
16 CIVIL SERVICE COMMISSION....D4
17 COLUMBIA HOSPITAL....A3
18 CONSTITUTION HALL (D.A.R.)....D4
19 CORCORAN GALLERY OF ART....D3
20 DAUGHTERS OF THE AMERICAN REVOLUTION....E4
21 DEPARTMENT OF AGRICULTURE....G4, H4
22 DEPARTMENT OF COMMERCE....F3
23 DEPARTMENT OF HEALTH, EDUCATION AND WELFARE. K2, K3
24 DEPARTMENT OF THE INTERIOR....D4
25 DEPARTMENT OF JUSTICE....H2
26 DEPARTMENT OF STATE....C5
27 DEPARTMENTAL AUDITORIUM....G3
28 DISTRICT BUILDING....F2
29 D. C. COURT OF GENERAL SESSIONS, CRIMINAL DIVISION....H1
30 D. C. DEPARTMENT OF PUBLIC HEALTH....J1
31 D. C. WAR MEMORIAL....E6
32 DOCTORS HOSPITAL....C2
33 EPIPHANY CHURCH....F1
34 EXECUTIVE OFFICE BUILDING....D3
35 F STREET PLAZA....F2
36 FEDERAL AVIATION AGENCY AND FUTURE LOCATION OF DEPARTMENT OF TRANSPORTATION....J3
37 FEDERAL BUREAU OF INVESTIGATION, IDENT. DIVISION..L3
38 FEDERAL RESERVE SYSTEM....D5
39 FEDERAL TRADE COMMISSION....H2
40 FIRST CONGREGATIONAL CHURCH....G1
41 FIRST DIVISION A. E. F. MONUMENT....D3
42 FOOD AND DRUG ADMINISTRATION....L3
43 FORD'S THEATRE (LINCOLN MUSEUM)....G1
44 FORT LESLEY J. McNAIR....M6
45 FREER ART GALLERY....H4
46 FRIENDSHIP BAPTIST CHURCH....M4
47 GARFINCKEL'S DEPARTMENT STORE....E2
48 GENERAL SERVICES ADMINISTRATION....D3
49 GENERAL SERVICES ADMINISTRATION REGIONAL OFFICE. J4
50 GEORGE WASHINGTON UNIVERSITY HOSPITAL....B3
51 GREENLEAF APARTMENTS....M4, M5
52 HARBOUR SQUARE....L6, M6
53 HECHT'S DEPARTMENT STORE....H1
54 HOUSE OFFICE BUILDING — CANNON BUILDING....M1
55 HOUSE OFFICE BUILDING — LONGWORTH BUILDING...L1
56 HOUSE OFFICE BUILDING — RAYBURN BUILDING....L2
57 HOWARD JOHNSON'S MOTOR LODGE....A4
58 INTER-AMERICAN DEVELOPMENT BANK....D2
59 INTERNAL REVENUE SERVICE....G2
60 INTERNATIONAL MONETARY FUND....C3
61 LANSBURGH NEIGHBORHOOD PARK....M4
62 LIBRARY OF CONGRESS....M1
63 LIBRARY OF CONGRESS ANNEX....M1
64 LISNER AUDITORIUM (G. WASHINGTON UNIVERSITY) B3
65 MAYFLOWER HOTEL....C1
66 MUNICIPAL CENTER....J1
67 MUSEUM OF HISTORY AND TECHNOLOGY....G3
68 MUSEUM OF NATURAL HISTORY....H3
69 NATIONAL ACADEMY OF SCIENCES....C5
70 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION....J3
71 NATIONAL ARCHIVES....H2
72 NATIONAL GALLERY OF ART....J2
73 NATIONAL GEOGRAPHIC SOCIETY....C1
74 NATIONAL PRESS CLUB....F2
75 NEW YORK AVENUE PRESBYTERIAN CHURCH....E1
76 OCTAGON HOUSE (AMERICAN INSTITUTE OF ARCHITECTS)...D3
77 OLD POST OFFICE TOWER....G2
78 PAN AMERICAN HEALTH ORGANIZATION....B4
79 PAN AMERICAN UNION....D4, E4
80 PEACE CORPS....D2
81 PHILLIPS COLLECTION (ART GALLERY)....A1
82 POST OFFICE DEPARTMENT....G2
83 RIVER PARK COOPERATIVE....M6
84 SAFEWAY INTERNATIONAL FOOD STORE....F1
85 ST. AUGUSTINE'S EPISCOPAL CHAPEL....L6
86 ST. DOMINIC'S CHURCH AND PRIORY....K4
87 ST. JOHN'S CHURCH, LAFAYETTE SQUARE....D2
88 ST. MATTHEW'S CATHEDRAL....C1
89 ST. MATTHEW'S LUTHERAN CHURCH....M5
90 ST. PATRICK'S CHURCH....G1
91 SECOND DIVISION A.E.F. MEMORIAL....E4
92 SMITHSONIAN INSTITUTION....H3
93 SOUTHWEST BRANCH LIBRARY....L4
94 STATLER-HILTON HOTEL....D1
95 TIBER ISLAND....L5
96 TOWN CENTER PLAZA....L5, M5
97 TREASURY DEPARTMENT....E2
98 TWELFTH STREET UNDERPASS ENTRANCE....G3, H4
99 ULYSSES S. GRANT STATUE....K1
100 UNION OF SOVIET SOCIALIST REPUBLICS EMBASSY..D1
101 UNION METHODIST CHURCH....C3
102 UNITED STATES CHAMBER OF COMMERCE....D2
103 UNITED STATES COURT HOUSE....J1
104 UNITED STATES INFORMATION AGENCY....D3
105 WASHINGTON GALLERY OF MODERN ART....A1
106 WATERGATE DEVELOPMENT....A4
107 WESTMINSTER PRESBYTERIAN CHURCH....L5
108 WHEAT ROW....M6
109 WOODWARD AND LOTHROP DEPARTMENT STORE....G1
110 WORLD BANK....C3
111 YMCA (CENTRAL)....D3
112 YWCA....D1

PLANNED OR UNDER CONSTRUCTION

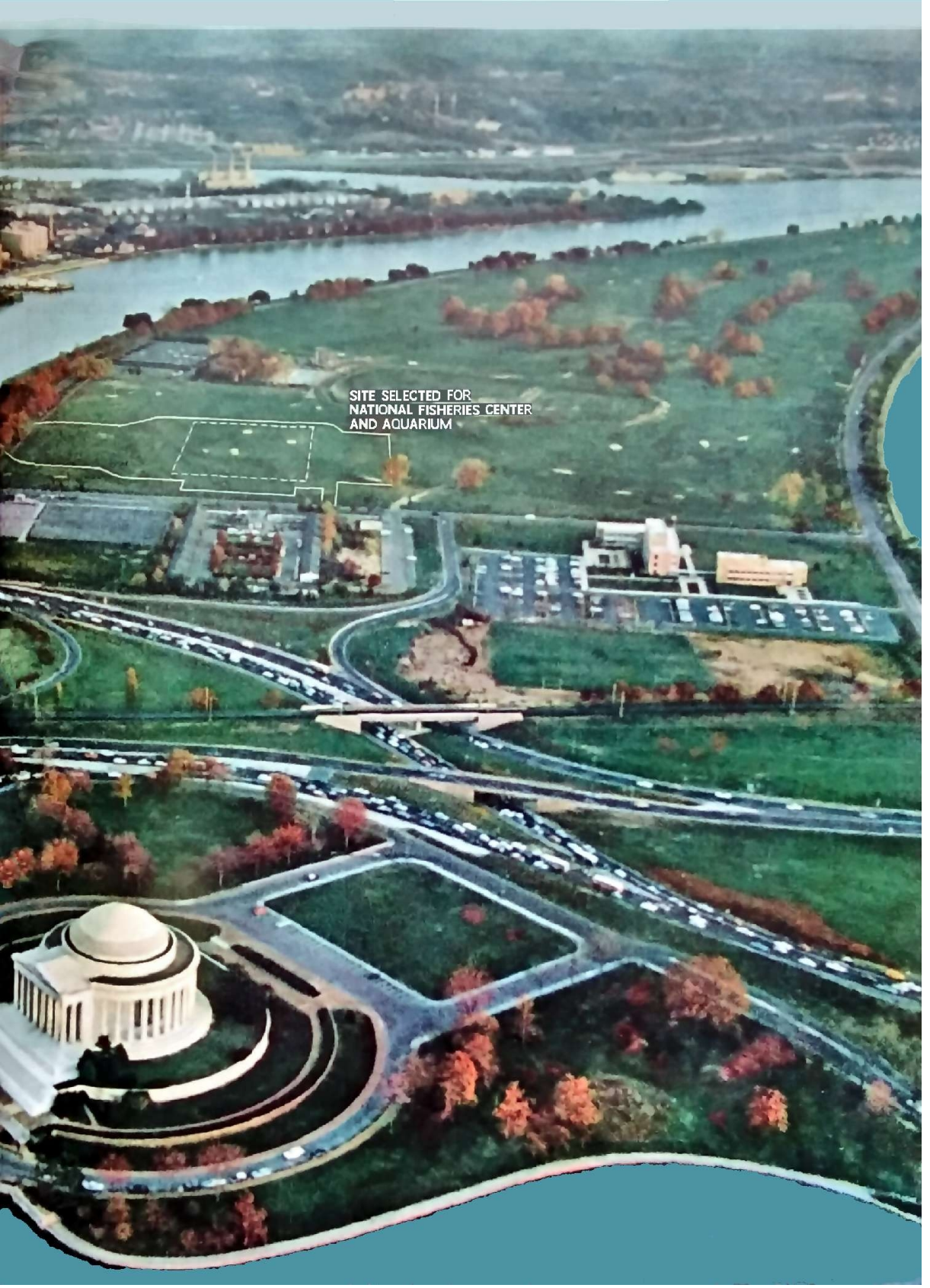
113 COLUMBIA PLAZA URBAN RENEWAL PROTECT....B4
114 DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT ..J4
115 DEPARTMENT OF LABOR....J1
116 DOWNTOWN CENTRAL LIBRARY....G1
117 EXECUTIVE OFFICE BUILDING....D2
118 FEDERAL BUREAU OF INVESTIGATION....G1, G2
119 FEDERAL RESERVE BOARD EXTENSION....D4
120 FIFTH BAPTIST CHURCH....K5
GEORGE WASHINGTON UNIVERSITY (121-124)
121 JOSEPH HENRY BUILDING....B3
122 MEDICAL CLINIC....A3
123 MEDICAL LIBRARY AND BASIC STUDIES....B4
124 UNIVERSITY CENTER....B3
125 GROUP HOSPITALIZATION INCORPORATED....J5
126 HOOVER PLAYGROUND....M5
127 HOUSE OFFICE BUILDINGS, UNDERGROUND GARAGES L2, M2
128 INNER LOOP FREEWAY, CENTER LEG TUNNEL ENTRANCE....L2
129 JAMES FORRESTAL BUILDING....H4, J4
130 JOHN F. KENNEDY CENTER FOR THE PERFORMING ARTS...A5
131 JOHN HANCOCK BUILDING....G2
L'ENFANT PLAZA (132-136)
132 AVIATION AND SPACE BUILDING....J4
133 COMSAT BUILDING....J4
134 HOTEL....J4
135 PLAZA AND SHOPPING PROMENADE....J4
136 WORLD COMMUNICATION CENTER....J4
137 LIBRARY OF CONGRESS JAMES MADISON MEMORIAL BUILDING SITE....M1
138 MAINE AVENUE APARTMENTS....L5
139 NASSIF BUILDING....K4
140 NATIONAL AIR AND SPACE MUSEUM....J3
141 NATIONAL PORTRAIT GALLERY AND NATIONAL COLLECTION OF FINE ARTS (OLD PATENT OFFICE)....G1
142 NINTH STREET UNDERPASS ENTRANCE....H2, J4
143 OVERLOOK....J5
144 RANDALL PLAYGROUND....M3
145 SOUTH PORTAL AIR RIGHTS BUILDING....K2
146 SOUTHWEST HOUSING ASSOCIATION....M6
147 TENTH STREET MALL....J4, J5
148 TOWN CENTER PLAZA SHOPPING CENTER....L5
149 TOWN SQUARE APARTMENTS....K4, K5
150 U. S. COURT OF CLAIMS AND U. S. COURT OF CUSTOMS AND PATENT APPEALS....E2

PROPOSED

151 ANDREW W. MELLON MEMORIAL FOUNTAIN....J2
152 ARCHIVES EXHIBIT PAVILION....H2
153 BELVEDERE....E2
154 CEREMONIAL ROAD....K2
155 CONSTITUTION AVENUE UNDERPASS....J2
156 D. C. MUNICIPAL CENTER....J1
157 E STREET TUNNEL ENTRANCE....C4, H1
158 EIGHTH STREET MALL....G1, H1
159 FIRST DIVISION PARK....E3
160 FOURTEENTH STREET TUNNEL ENTRANCE....E2, H5
161 FOURTH STREET UNDERPASS ENTRANCE....J2, K2
162 FRANKLIN DELANO ROOSEVELT MEMORIAL....E6
GEORGE WASHINGTON UNIVERSITY (163-166)
163 CENTER FOR LATIN AMERICAN STUDIES....B4
164 COLUMBIA COLLEGE SCIENCE CENTER....B3
165 LIBRARY....C3
166 STUDENT ACTIVITIES BUILDING....B4
167 GRAND OVERLOOK TERRACE AND VISITORS CENTER. .G4
168 GRAND PLAZA....G3
169 HIRSHHORN MUSEUM AND SCULPTURE GARDEN....J3
170 HOTEL....F2
171 INNER LOOP FREEWAY, SOUTH LEG TUNNEL ENTRANCE C6, H5
172 INTERNAL REVENUE BUILDING EXTENSION....G2
173 INTERNATIONAL CENTER....A2
174 JAPANESE WATER GARDEN AND TEA HOUSE....E6
175 L'ENFANT SQUARE NATIONAL SCULPTURE GARDEN. H2
176 LINCOLN PLACE (PEDESTRIAN MALL)....G1
MALL ORIENTATION CENTER (177-179)
177 BUS PARKING LOTS....D5
178 RECEPTION HALL....D5
179 RESTAURANT....D5
180 MARKET SQUARE....H2
181 NATIONAL SQUARE....F2
182 OLD NAVAL OBSERVATORY HILL PARK....B5
183 PENNSYLVANIA AVENUE ANNEX....F2
184 PERSHING MEMORIAL....F2
185 REFLECTING POOL EXTENSION....E5
186 ROSE GARDEN....E4
187 ST. DOMINIC'S SCHOOL....K4
188 SEVENTH STREET UNDERPASS ENTRANCE....H2, J3
189 SHOPPING ARCADE....F2
190 SOUTHWEST WATERFRONT....K5, L5
191 SYLVAN THEATRE SITE....G5
192 THE PORTAL SITE....H5
193 UNITED STATES CAPITOL PLAZA....L1
194 VIRGINIA AVENUE AIR RIGHTS BUILDING....A4
195 WASHINGTON CHANNEL BRIDGE, "PONTE VECCHIO". J6
196 WETA (EDUCATIONAL TV)....K5
197 WHITE HOUSE ENTRANCE PLAZA....E2
198 WHITE HOUSE GATE....E2
199 WOODROW WILSON CENTER FOR SCHOLARS....H1

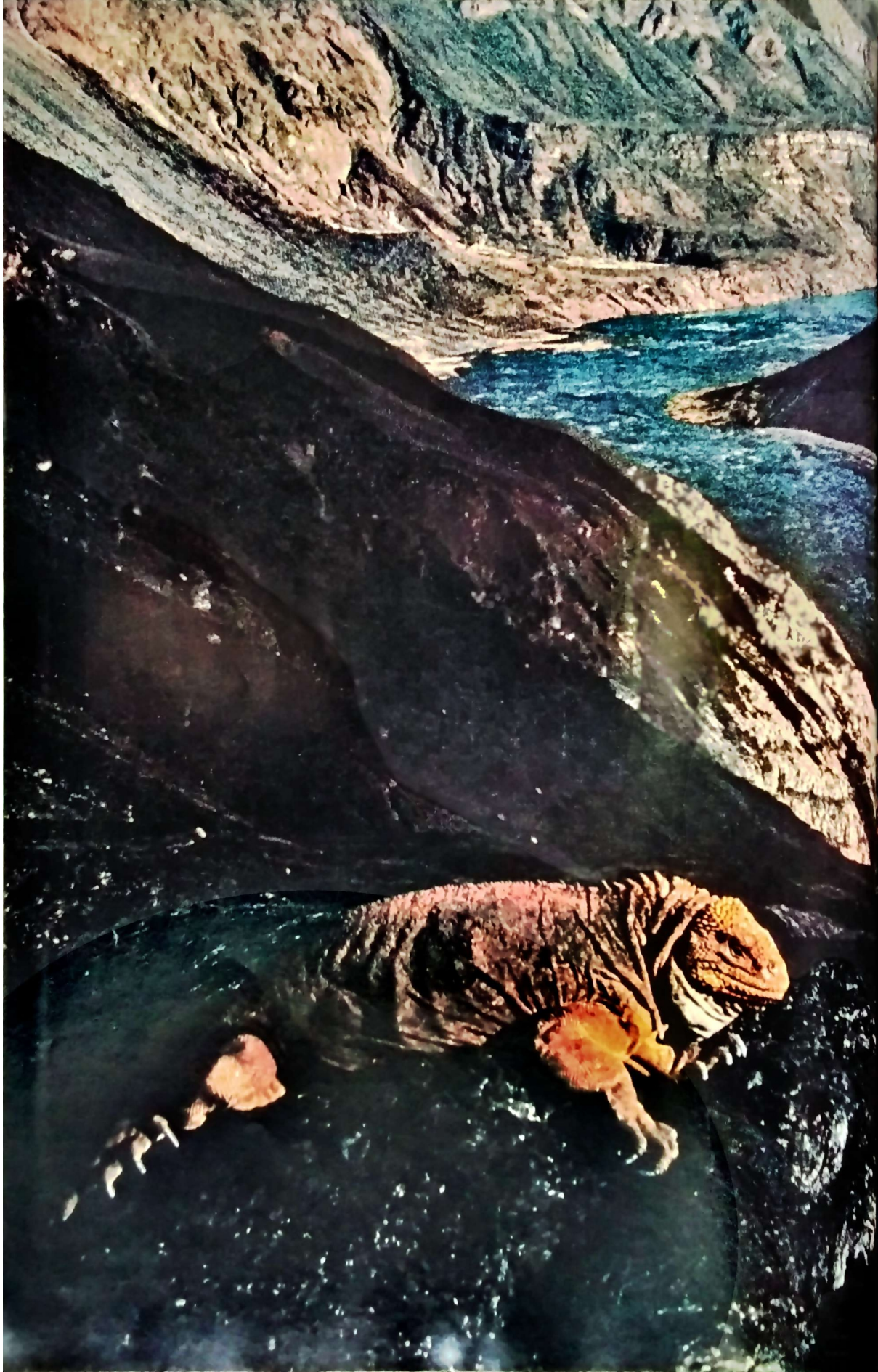


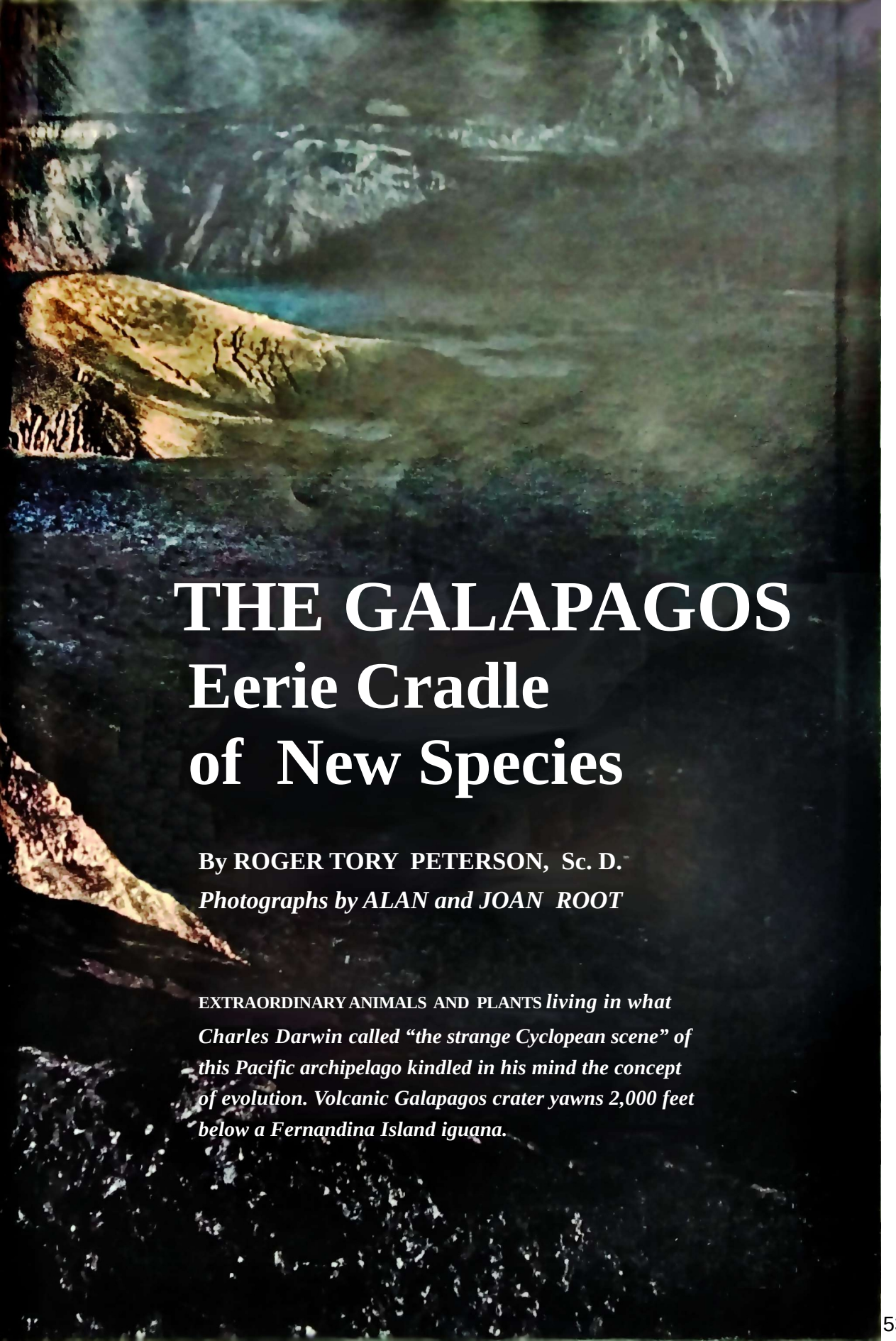
Failing glow of day highlights the serene Thomas Jefferson Memorial, standing beside the Tidal Basin; beyond it, the new skyline of the old Southwest fringes Washington Channel. The Anacostia River, in background, flows to meet the Potomac, to the right of Hains Point. In years to come, tourists will traverse



JAMES P. BLAIR © NATIONAL GEOGRAPHIC SOCIETY

a new mall along Tenth Street and board small buses at an overlook above a garage, at left. The buses will carry them across a Ponte Vecchio type of bridge containing 100-odd shops, and on to a future aquarium. White lines enclose areas of planned construction on the present East Potomac Park public golf course.





THE GALAPAGOS
Eerie Cradle of New Species

By ROGER TORY PETERSON, Sc. D.
Photographs by ALAN and JOAN ROOT

EXTRAORDINARY ANIMALS AND PLANTS *living in what Charles Darwin called "the strange Cyclopean scene" of this Pacific archipelago kindled in his mind the concept of evolution. Volcanic Galapagos crater yawns 2,000 feet below a Fernandina Island iguana.*

THESE WERE THE FINCHES that shook the world, I reminded myself — the famous Darwin's, or Galapagos, finches.

A pair of the little dark birds hopped about my feet and busily picked up tufts of hair snipped from my gray locks. The adaptable birds were using this windfall for lining their nest in a nearby tree cactus.

Terry Shortt (qualified by a knowledge of taxidermy) acted as my barber. He had come all the way from Canada to this equatorial archipelago — the Galapagos Islands, 600 miles off Ecuador — to gather material for a diorama of the Galapagos scene for the Royal Ontario Museum in Toronto. I had come with a Canadian Broadcasting Corporation camera crew to interpret Charles Darwin and his theory of evolution for television audiences.

I was fascinated by the ever-present finches. Seldom were we out of hearing of their monotonous songs: such repetitious phrases as *T-shirt, T-shirt*, or *Charlie-D, Charlie-D*, or *jib-jib-jib*. Their coarse voices and rude ways reminded me of the house sparrows back home.

When Darwin, aged 26, stepped ashore in the Galapagos 132 years ago, the islands reminded him of "what we might imagine the cultivated parts of the Infernal regions to be". Yet by contemplating the small finches peculiar to this craggy archipelago, he was to arrive at one of the basic concepts of all time.

He noted that the finches differed from island to island, yet seemed to have had a common inheritance, a phenomenon that naturalists now call "adaptive radiation". Twenty-four years later, he published his famous *On the Origin of Species by Means of Natural Selection*. Since then, man's view of the world has not been the same.

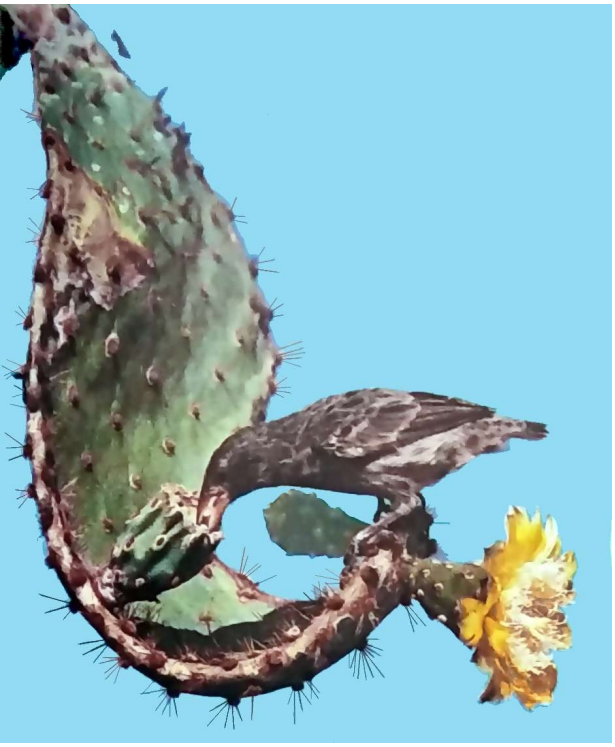
The year of Darwin's visit was 1835. His ship was the British survey vessel H.M.S. *Beagle*, on a five-year voyage around the world. As the unpaid naturalist of the expedition, he spent five weeks intensively exploring the islands (map, pages 576-7). And here he found intriguing clues leading toward his radical theory of the evolutionary design of life.

But what would Charles Darwin have thought of the four-engine plane that had flown me from the coast of South America in scarcely more than three hours? Would he have put it down to "natural selection" or "evolution"?

And what would he have thought of this, I wondered, as I surveyed the cluster of low buildings — dormitories, laboratories, workshops. This was the new Charles Darwin Research Station, dedicated in 1964.

The site chosen for the station was Academy Bay, on the south shore of Santa Cruz Island. It stands just behind a rocky beach amid the islands' finest forest of tree cactus — *Opuntia*, with flat beavertail pads and orange trunks towering 30 feet or more, and *Cereus*, like gaunt, ribbed drainpipes.

Feathered vampire of Wolf Island, a sharp-beaked ground finch rests on the tail of a masked booby from which it has taken a meal of blood. *Geospiza difficilis* feeds by stabbing the soft skin at the base of the larger bird's secondary wing feathers.



“A most singular group of finches”, wrote Darwin — and modern scientists agree. Drab in plumage and song, 13 species of Galapagos finches in 3 genera differ remarkably from each other in the size and shape of their beaks.

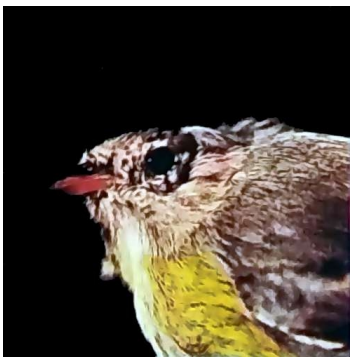
Strong, slender bill helps *Geospiza scandens* (left) probe a pulpy calyx of a prickly-pear cactus on Plaza Island; essentially the same bird with a shorter beak, *fuliginosa* harvests ticks from an iguana on Santa Cruz (below).

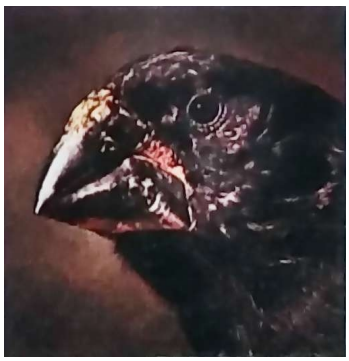
“One might really fancy”, Darwin conjectured, “that from an original paucity of birds… one species had been taken and modified for different ends”. From such observations came the momentous theory later expounded in his classic *On the Origin of Species by Means of Natural Selection*.

Nature’s enchanted isles

REMOTE, STARK, UNEARTHLY, Ecuador’s Galapagos Islands in the Pacific Ocean abound in biological wonders. During a five-week visit to the volcano-spawned archipelago in 1835, young Charles Darwin marveled at animals unlike any others. These eerie heaps of lava nurture sea-diving iguanas, gigantic tortoises, flightless cormorants, and swallow-tailed gulls. But nothing intrigued Darwin more than the Galapagos finches.

Today “Las Islas Encantadas” — enchanted islands of sailors’ tales — still hold surprises for science, such as a tool-using bird (pages 572-3) and a blood-eating finch (left), whose startling habit was not discovered until 1964.





ALAN ROOT © N.G.S.

Cousins of Genovesa Island demonstrate changes over countless generations since their common ancestors arrived in the Galapagos, possibly on a gale from the mainland. *Geospiza magnirostris* cracks hard seeds with the biggest bill among the birds now called Darwin’s finches. The warbler finch, *Certhidea olivacea*, eats insects with the smallest.

Web-toed tightrope artist, a red-footed booby disdains a curious intruder — *Beagle II*, anchored below perilous cliffs of remote Wolf Island (page 553). Named for the ship that brought Darwin, the vessel sails under the aegis of the Charles Darwin Foundation and its research center at Academy Bay on Santa Cruz (map, pages 576-7).

Beagle II carried the author when he visited the islands in 1965. He had earlier studied their fauna as a member of the Galapagos International Scientific Project. This 1964 expedition — organized by the University of California, Berkeley, and sponsored by the National Science Foundation, the Government of Ecuador, the California Academy of Sciences, and the Darwin Foundation — subjected the lonely archipelago to an intensive six-week scrutiny.

ALAN ROOT © N.G.S.

With typical Galapagos tameness, immature boobies greet Joan Root on *Beagle II* off Genovesa Island. Last fall she and her husband Alan, residents of Kenya, made many of the dramatic photographs that illustrate this article.

Financial support for the station comes from many sources — governments, scientific bodies, and individuals, most of it contributed through the United Nations Educational, Scientific and Cultural Organization. The station's basic purpose is to furnish field facilities to visiting biologists. A second purpose is to protect the unique and vulnerable wildlife, now guarded by conservation officers.

Nowhere are the Galapagos finches more numerous than around Academy Bay. Scores of them come every morning to feed on the rice that Roger Perry, the station's director, scatters outside his door. Some are so tame they eat from his hand. Others enter the living room to glean insects trapped inside the windows.

Beaks Differ Among Related Birds

Darwin recognized 13 species of Galapagos finches, the same number that ornithologists find in the islands today, although classifications have changed. I have filmed ten species. They all look much alike — little dusky-brown or blackish birds with stubby tails. They differ mainly in their bills, which vary from small, thin beaks resembling those of warblers to huge, thick ones like those of grosbeaks (see paintings, pages 576-7).

In 1845, ten years after his visit, Darwin wrote about the finches: "Seeing this graduation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends."

But he was far from ready to state unequivocally that such a variety of birds could evolve from a single species. Even if he had been, it was too controversial a position to take at that time. Every species, most people then believed, had come into being in its present form in one great flash of creation, pinpointed by theologians at 4004 B.C. It was a tenet of faith.

Over the years, however, Darwin accumulated his evidence. In 1859 he laid his cards on the table in *The Origin of Species*.

Today it is generally accepted by scientists that all finches in the Galapagos come from a common stock, from some lost mainland finches marooned there long ago. Their descendants, pioneering further, became isolated on various islands. Adapting to local conditions, they developed physical differences.

ALAN ROOT ® NATIONAL GEOGRAPHIC SOCIETY

Those with larger beaks could crack larger seeds; those with longer bills could probe the deep cactus blossoms; those with smaller bills could exploit the tiny insects. Genetic traits that had survival value were preserved.

Stray birds of many kinds have undoubtedly made landfalls in the islands, but few have survived. In these finches, however, we have a particularly tough, plastic stock — evolutionary potter's clay. And we can perhaps argue that a harsh environment demands ruthless ways. I noticed that when a finch wished to drive a neighbor off its perch it would often hit it rudely with both feet.

On Española, or Hood Island, I watched a finch that most certainly must be the champion weight lifter among songbirds. This species, the large cactus ground finch, *Geospiza conirostris*, uses its sturdy bill to flip rocks in search of food. After watching one at work, we put several of its rocks on the scales. The largest weighed about seven ounces — more than fifteen times the weight of the bird.

Twigs Become Tools for Woodpecker Finch

The woodpecker finch, *Camarhynchus pallidus*, exhibits an extremely rare talent among birds: tool-using. Lacking the true woodpecker's long bill and tongue, it has developed an ingenious technique for digging out grubs. I watched one pick up a sharp twig and probe a hole in a limb. Out popped a grub. The finch swiftly dropped the twig and seized the morsel in its beak (pages 572-3).

Dr. Robert I. Bowman of San Francisco State College, who perhaps knows more about Darwin's finches than anyone else, reported an astonishing discovery in 1964. Landing by helicopter on almost inaccessible Wolf Island, he and his colleagues saw the sharp-beaked ground finch, *Geospiza difficilis*, alight on a booby, bury its face in the wing feathers, and bite the skin. It then fed on the oozing blood, the first recorded instance of blood-eating as a primary feeding method by a bird (page 540).

My favorite finch was *Geospiza scandens*, the cactus ground finch, which plunged its long beak deep into cactus blooms and fruit to feed (page 541). *Scandens* would investigate anything; it frequently entered my room to pull horsehairs from the mattress for nest lining.

Scientists regard the Galapagos as perhaps the world's best laboratory for studying how species become differentiated. Evolutionary forces, of course, are busy everywhere, but the detective work of the biologist is easiest on islands. On continents, the clues are not as evident, the story not as clean-cut.

Isolation Favors Divergent Traits

Far from the nearest large land mass, the Ecuadorian-owned archipelago straddles the Equator 600 miles west of South America and 800 miles southwest of Panama (map on page 576). To the west, the open Pacific rolls for 3,000 miles before another island breaks its surface. This isolation limits the number of colonizers. Equally important, the islands lie just far enough apart so that individuals of a species only occasionally get from one island to another. This lack of contact gives local populations a chance to develop differences.

The Archipiélago de Colón, as the islands are officially known, has an area of 3,000 square miles. It includes 13 main islands and many smaller islets and rocks. The largest island, 80-mile-long Isabela, has five major volcanic peaks, the highest rising to 5,600 feet.*****

Ocean currents mingle amid these isles. The Peru, or Humboldt, Current, born in Antarctic waters, flows north along South America's coast and then, becoming the South Equatorial Current, swings west through the islands, making them a fit habitat for such cold-water dwellers as penguins, albatrosses, and seals.

For reasons not yet known, the Peru Current is displaced along the coast each winter by a warmer, less saline flow from the Gulf of Panama. In 12 major instances over a recent period of 140 years, the tropical waters have surged far south, killing great concentrations of fish off the continent's shores, and bringing winds, thunderstorms, and cloud-bursts to the Galapagos.

***** Irving and Electa Johnson told how they sailed *Yankee* to the "Lost World of the Galapagos" in the May, 1959, issue of NATIONAL GEOGRAPHIC.

Most colorful marine iguana, this gentle dragon of Española Island soaks up heat on rocks that may reach 120° F. The cold-blooded reptile depends on the sun to bring its body temperature up to 95° after chilling plunges into the sea have dropped it to 79° or less. *Amblyrhynchus cristatus* feeds at depths of as much as 30 feet.

This current is called *El Niño*, after the Holy Child, because the shift in flow usually starts around Christmas.

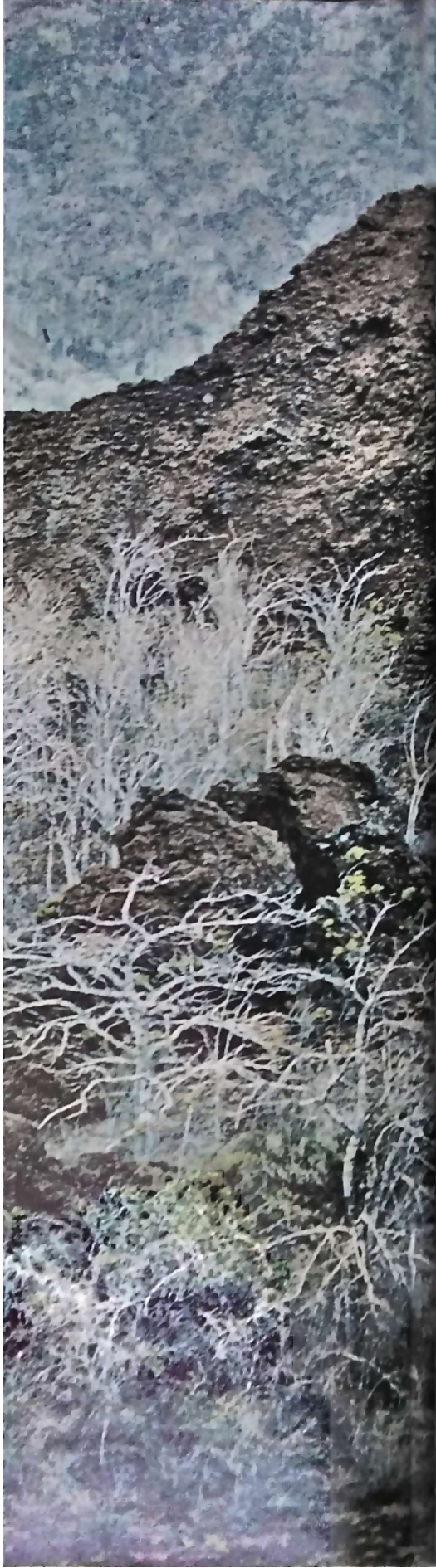
Our year of 1965 was a violent one for El Niño. For days clouds gathered in dark masses over Academy Bay, but no rain fell. Then, one noonday as we sat down to eat in the newly built dining hall, we were startled by the deep rumble of thunder, a sound rarely heard in the islands. The heavens opened up. I covered my motion-picture camera with a rubber sheet and ran out to document this deluge in the desert. Within two hours the water tanks were filled for the first time since they had been installed.

Day after day it rained, and the landscape quickly changed from brown to green. For a brief time we saw rushing streams, even small waterfalls, on these usually bone-dry isles.

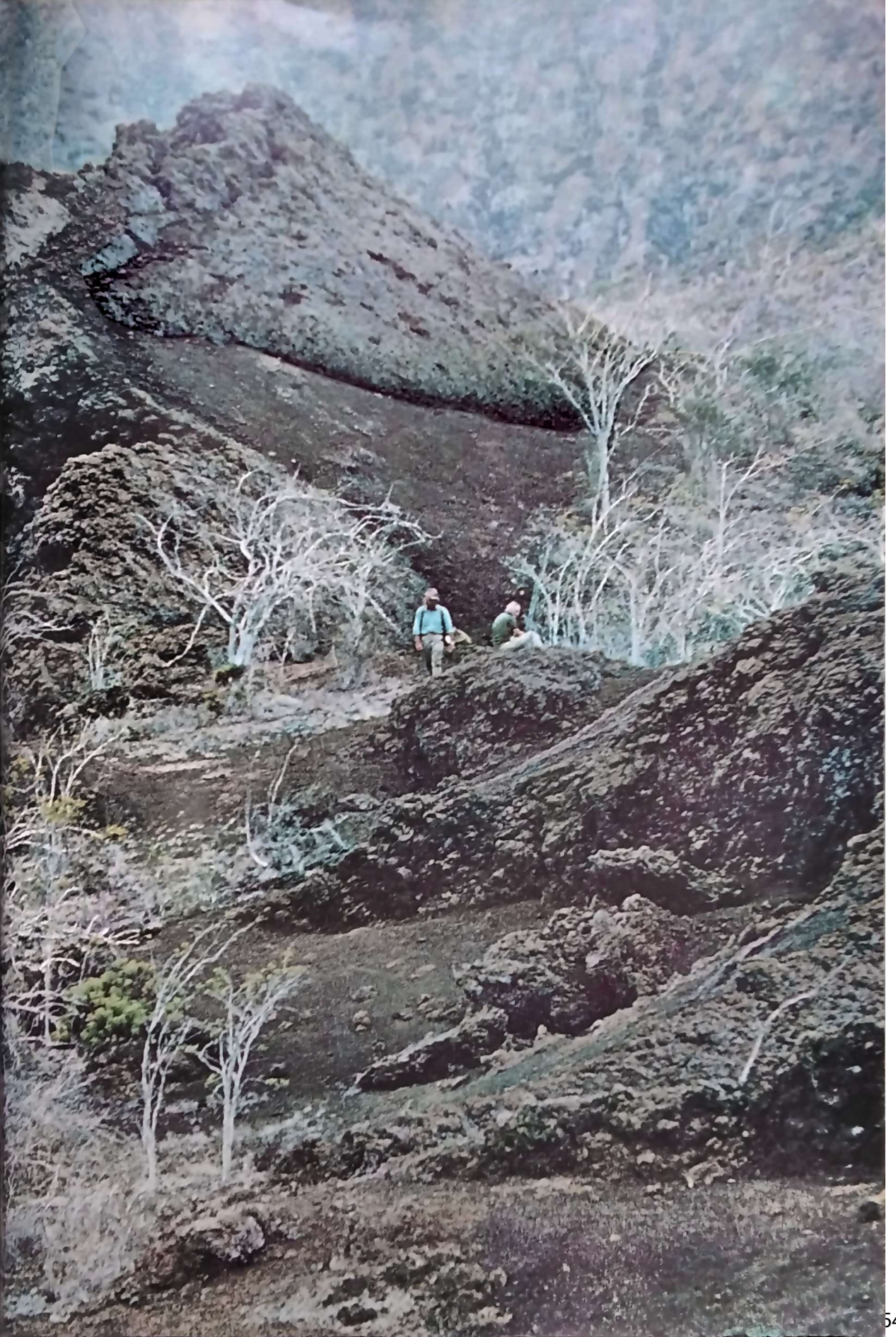
When I had arrived on this, my second visit in two years, a handsome man with a spade beard met me at the pier near the airstrip on Baltra Island, off Santa Cruz's north shore. He was my friend Carl Angermeyer — "Mr. Galapagos", as he is called, then in charge of the station's new boat, *Beagle II* (page 553).

ALAN ROOT (ABOVE); FLIP SCHULKE, BLACK STAR © N.G.S.

Blending with a basalt landscape, the lava gull's charcoal coloring helps it escape the notice of hijacking frigatebirds. A landlubber, *Larus fuliginosus* searches the shore for crustaceans and scavenges for a livelihood.



In the netherworld of Tagus Cove on Isabela Island, the author rests blistered feet while Dr. George A. Bartholomew, biologist from the University of California at Los Angeles, pushes ahead. A day's walk over these rugged waves of jagged lava can shred a hiker's boots. But scientists gladly accept such discomfort for the opportunity to study the unique wildlife of this island laboratory.



"How do you like it?" he grinned, waving his arm toward the anchored brigantine. "It will be your home while you're exploring the rest of the islands."

When we reached *Beagle*'s mooring in Academy Bay, on the south shore of Santa Cruz, Carl proudly pointed out the Angermeyer home, a picture-postcard cottage above the green water. After leaving Hitler's Germany as youths in 1937, Carl and two brothers had forged a new life for themselves in the Galapagos. They had hunted the wild goats that roam the volcanoes, caught rock lobsters and groupers, and even tried their hand at farming.

Islanders Hail From Many Nations

About 3,500 people of 14 nationalities share these tropical islands, principally Santa Cruz and San Cristóbal, also known as Chatham. Many dwell in two upland farming communities. The others subsist mostly on fishing.

Late one afternoon I took *Beagle II*'s outboard-equipped dinghy to visit Carl at his attractive eyrie by the sea. He was in the patio working on a large canvas of a Galapagos scene, for he includes painting among his many accomplishments. While he was puffing on his pipe and brushing a wide sky onto his canvas, a big macaw winged across the bay and landed on his shoulder.

"This is Monty", said Carl. "He belongs to Bud Devine, the American who runs the cafe."

I extended my hand toward Monty and nearly had a finger nipped off.

"Better not", advised Carl. "Except for Bud, I'm the only one who can touch him."

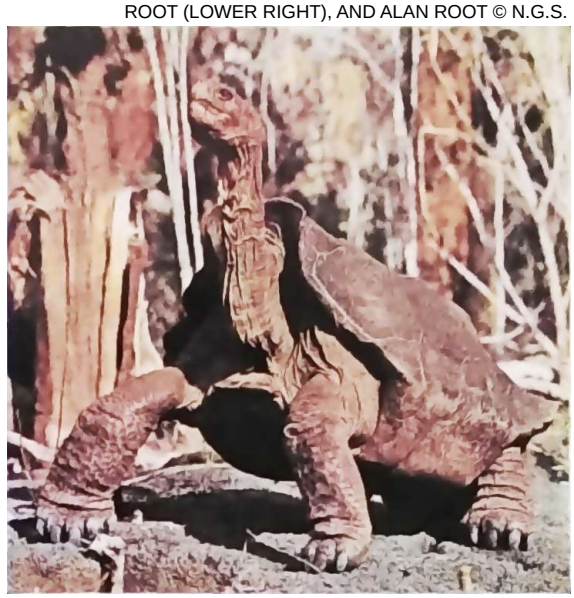
Obviously Monty had developed an obsessive attachment to Carl, as any sensible macaw would. Rewarded with a cracker, the resplendent bird flew back across the bay to a clump of coconut palms. He looked most startling against the jade water — and somehow out of place, as indeed he was, having been brought from the mainland as a pet.

Three large black marine iguanas were sunning themselves near the porch. One of the grotesque, wrinkled lizards crawled through the open door to take its place in the stone fireplace where it habitually spent the night.

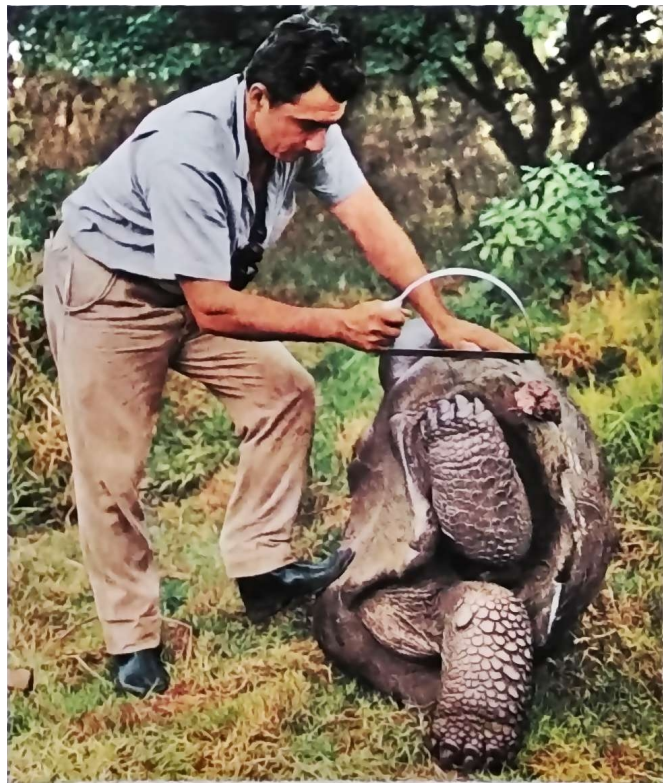
Immersing its bulk in a rain pond enables a 500-pound *galápago* to keep mosquitoes off its soft parts while it sleeps (bottom). Vermilion flycatcher finds the tortoise's four-foot-long carapace a handy lookout. The great animals that gave their Spanish name to the archipelago roamed at least 10 islands before sea captains wiped out whole herds to provision ships. Today the ponderous reptiles survive in numbers on only two islands — Santa Cruz and Isabela. Even here, pigs, dogs, and rats destroy hatchlings and billiard-ball-size eggs (below), threatening the giants' survival.

Saddle-shaped carapace allows a tortoise of arid Española Island to stretch upward to feed. Tortoises wear shells of a different shape on Santa Cruz, where they nibble succulent ground cover in moisture-drenched highlands. On each island, scientists reason, the subspecies of *Testudo elephantopus* evolved a carapace compatible with local conditions.

ROGER TORY PETERSON (UPPER LEFT), JOAN ROOT (LOWER RIGHT), AND ALAN ROOT © N.G.S.



Christened with a hacksaw, this tortoise will wear telltale notches the rest of its life. The painless marking system helps Ecuadorian conservation officer Miguel Castro keep track of the growth, age, and travels of 1,000 tortoises in a reserve on Santa Cruz.



Although these yard-long reptiles, the only marine lizards in the world, had been thought to feed solely on algae and seaweed, Angermeyer's wild pets have developed unorthodox tastes. They eagerly devour boiled rice and pancake batter, and will take raw fish from one's fingers. They even share milk and porridge from the same saucer with the family cat. Yet no zoo in the world had been able to keep them in numbers until Chicago's Brookfield began to build a colony three years ago.

Marine iguanas like Carl Angermeyer's pets were but one species among many that had undergone intensive scrutiny the year before as part of the Galapagos International Scientific Project. I had been privileged to join the fifty participants who attended the dedication of the Charles Darwin Research Station, and who remained to study the birds, the tortoises, the tide pools, forests, lava flows, and volcanic peaks.

These specialists from several countries spent six weeks examining the islands as they had never been examined before. Their purpose was twofold: to catalog the incompletely known rocks, plants, and animal life, and more important, to probe deeper into the evidence for evolution.

The Government of Ecuador provided patrol boats, and the United States lent ships and helicopters. From dawn to dusk the scientists pondered the ways of sea lions and sea birds, hammered at rocks, dived for marine life, collected plants. They examined not only the insects but also the smallest parasites of the insects. Nothing was too obscure to escape their scrutiny. And wherever they went, Darwin's finches sang their coarse songs to remind them of the genius who found his greatest inspiration in these islands.

ALAN ROOT © N.G.S.

Puffed-up pirate, a frigatebird displays his crimson glory by inflating a throat sac. The bird may puff to proclaim his right to a territory. Better thief than fisherman, *Fregata minor* bullies other sea birds into dropping their catches, which it then seizes in mid-air. Wings spanning seven feet propel this powerful flyer, a species found across the Pacific and in the Indian Ocean.

Pioneer Naturalist Saw Few Insects

During their field studies, most of these academic men neglected their razors until they looked as disreputable as beachcombers. One day a Swedish training ship dropped anchor in Academy Bay. The young cadets, all spit and polish, were soon swarming ashore to see the sights. Some wandered into the settlement's tiny waterside cafe, where half a dozen bearded scientists were relaxing. Out came the cameras. The youthful Nordics shot dozens of pictures of the "picturesque Galapageños".

Darwin, who was interested in everything that flew, swam, walked, or crawled, commented that the insects of the Galapagos were sparse and drab. Yet I saw large flying grasshoppers with gaudy stripes of red and yellow swarming about the lights. Hawk moths of nearly a dozen species fell to my net. Black caterpillar-hunter

beetles and longhorn beetles scrambled across the paths. Pale-golden sulphur butterflies competed with large black carpenter bees for the nectar in the waxy yellow cactus blossoms.

Scorpion's Cargo Yields a Boy's Bonanza

The entomologists stretched sheets across the dormitory walls and flooded them with fluorescent light. Insects swarmed in by the hundreds. Many that we popped into the cyanide bottles proved new to science — further evidence for the evolutionary process. In this primordial isolation they had developed differences from their mainland ancestors.

Galapagos scorpions are huge; to avoid their painful stings, we examined our shoes carefully each morning. When Dr. George E. Lindsay, Director of the California Academy of Sciences, visited the station, he offered the children of the village two sucres (about 11 cents) per scorpion. One boy brought in a big one. When it was put into the poison jar, off jumped 18 baby scorpions. True to his word, Dr. Lindsay paid out 38 sucres to the lucky boy.

Not long ago, a group of tourists who came to Santa Cruz from Guayaquil, Ecuador, on the semi-monthly boat asked to see the tortoises, the Spanish name of which — *galápagos* — gave the islands their name. The visitors were dismayed to learn that the wild ones could be reached only after a long day's hike, for their boat was due to sail again in a few hours. For such guests the station now keeps several captives in a two-acre enclosure.

One day I watched two biologists as they tried to feed one of the tortoises a miniaturized radio transmitter. They hoped to record temperatures as the device made its slow journey through the alimentary tract. First the tiny radio was inserted into a tempting banana. Promptly the two largest tortoises engaged in a contest for the morsel. Banana and radio were trodden into the mud, and it took a good deal of searching to recover the instrument. Undismayed, the biologists tried again, and this time they succeeded.

Once, as I tried to film one of the captives eating a cactus pad, another shambled up behind me. Mistaking my bare leg for something edible, it gave me an exploratory bite, leaving a livid bruise. Few naturalists, I suppose, can claim the distinction of having been bitten by a giant tortoise.

The year before, while strapped in the doorway of a helicopter, I saw my first wild, free-ranging tortoises on Santa Cruz. Amid lush uplands, they glistened like black bubbles on the green margins of rain-filled ponds.

After the aerial glimpse I was determined to see this colony from the ground. But it was not until my return the next year that arrangements

ROGER TORY PETERSON © N.G.S.

Toying with a crab, a great blue heron torments its scarlet quarry, then tosses it aside. Fish-eating *Ardea herodias* perhaps found its way to the islands from Mexico, the nearest breeding site on the mainland. It now constitutes a distinct subspecies, with paler plumage. Three other species of heron range to the Galapagos, and another, the cattle egret, was recently reported.

could be made for the trek, a six-to-eight-hour journey by horseback. My mount, a scrawny little animal innocent of shoes, picked her way over the lava boulders as sure-footedly as any mountain goat. As we climbed, the parched cactus forest slowly gave way to a twilight zone between wet and dry.

After we passed through the village of Bella Vista, the lushness of the high country again astonished us. For several miles agriculture had taken over: plantings of bananas alternated with bed of watermelons and pineapples. Galapageños on donkeyback gravely greeted us with "*Buenos días*".

Weak-winged Migrants Find a New Home

Darwin's finches were never out of hearing, and frequently the island's most colorful songbird, the vermilion flycatcher, danced its butterfly-like display in the air above (page 578). Once a small, dark bird resembling a baby chick ran down the rutted track ahead. It was the elusive black rail, the first I had ever seen, though it was once known as a rare resident of the marshes near my Connecticut home.

A pair of these weak-winged birds, carried off course by wind during migration, must have found each other and established a thriving outpost here — though not long enough ago, we presume, for them to have undergone much evolutionary change. The rails are abundant on the high moors of Santa Cruz.

Farmlands gave way to open moors where brambles arched across the path and tore at our clothes. These plants, useless European invaders, have taken over whole square miles of uplands. It was a relief to enter the native forest again, where ferns of a dozen species crowded the path.

While indulging in botanical musing, I was suddenly reminded of our objective. In a shallow rainpool lay the bleached and broken shell of a giant tortoise. A hunter of long ago had bashed it in for a few pounds of meat.

A short distance beyond, my horse reared suddenly; there, right in the path, was an honest-to-goodness live *galápago*. It exhaled with a deep sigh, sounding just like a deflating inner tube, pulled in its head, and blocked the entrance to its domed carapace with its huge armored forelegs. My little horse was terrified. No amount of coaxing would induce her to pass the monster, and we had to take the long way around.

A camp had been prepared in the tortoise reserve, where the rest of our party joined us for a stay of three days. Here, in an area of several thousand acres, roam some 1,000 tortoises, most of them marked by conservation officer Miguel Castro.

In a grassy pool, Miguel found a huge unrecorded male with a shell more than four feet long. I asked how much it might weigh.

"My guess is about 500 pounds."

"And how old would it be?"

"Maybe 200 years. But we don't know. That is one of the reasons we mark them. We also want to know how far they travel."

With his brawny helper, Miguel tipped the beast on its side, where it waved its legs helplessly (page 549). Using a small hacksaw, he cut three triangular notches about an inch deep along the edge of the carapace. By notching various plates in different combinations he could identify every individual.

The rains had dispersed the tortoises over a wide area. Even so, we could always find a few of the giants beside several permanent ponds near camp. One even wandered into our supply tent. The mockingbirds and vermilion flycatchers frequently used the animals as convenient places to sit.

Cradle Becomes Grave in Dry Season

Truly, this is the Garden of Eden, I thought, as I walked through the green groves hung with bearded moss and ferns. The sensation was heightened at night, when I left my tent and stole through the silent, moonlit glades. Here and there, glistening in the moonlight, slept a great tortoise, half-immersed in a muddy pool. They spent the whole night immobile, their soft parts protected from bothersome mosquitoes by the mud and water.

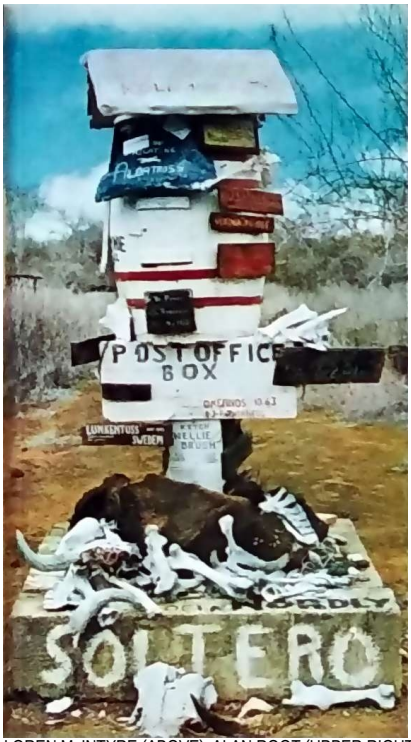
On the day before we broke camp, Miguel Castro guided John Livingston, our expedition leader, and myself to the nesting grounds of the tortoises, where a shallow valley flattened into a semiarid plain. Here the females come to lay their round eggs in pockets of red earth.

Miguel had located several nests and had erected low walls of lava rock around them.

"To keep out the wild pigs and donkeys", he explained.

Scooping his hands into a nest, he pulled out several earth-stained eggs the size of billiard balls. Exploring farther, he found a newly hatched three-inch baby. Its flipperlike legs worked frantically in an attempt to escape.

Make-do mailbox on Santa Maria, or Charles, Island, serves an ocean-wide postal zone. The custom began two centuries ago when outbound whalers left letters to be picked up by vessels headed home. Crews of ships and yachts periodically repair the barrel on a post, adding their names to its ornamentation, which includes piles of animal bones found lying about the area. In the War of 1812, U.S.S. Essex captured a dozen British ships, aided by information in letters purloined from the box.



LOREN McINTYRE (ABOVE), ALAN ROOT (UPPER RIGHT), AND ROGER TORY PETERSON © N.G.S.

Seas explode behind *Beagle II* on Wolf Island's sheer face. Despite a swamped longboat, the brigantine's crew landed Alan Root on a wave-dashed rock. He scaled the cliffs for the unusual pictures on pages 540 and 542.

"Galapagos Crusoe", Carl Angermeyer carries a friend's pet macaw on his shoulder. The bearded islander, who emigrated from Hitler's Germany before World War II, served as captain of *Beagle II* when the author explored the islands aboard the 55-foot vessel.

“Eight or nine eggs might be laid in a nest”, he said. “But often only one or two babies are able to get out of the hard-packed earth — particularly if it hasn’t rained. For the rest, the cradle becomes a grave.”

Carefully he replaced the unhatched eggs and their covering of soil. He painted a temporary number on the baby and released it to join a two-week-old youngster — already marked — which we found in the grass nearby.

Although tortoises once lived on at least 10 islands, flourishing populations remain on only two — Santa Cruz and Isabela (map, pages 576-7). Man and his wrecking crew have done for the rest. Pigs, dogs, and rats have killed defenseless young; goats and donkeys have taken the meager food supply on the drier islands.

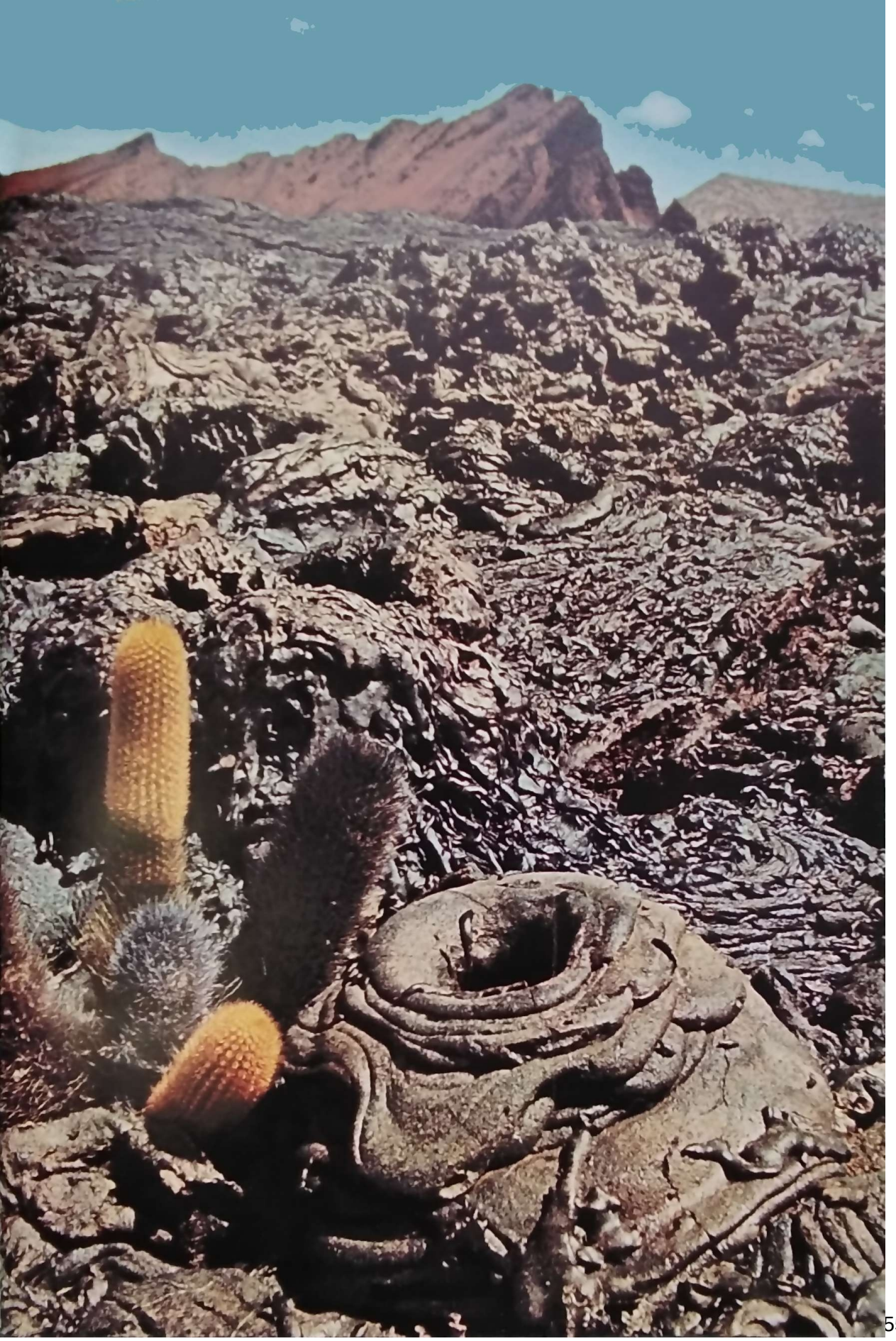
But man himself has been the most lethal predator of all. Beginning nearly 300 years ago, pirates, men-of-war, sealers, and whalers provisioned their ships with this durable staple. Capt. David Porter, U.S.N., commander of the frigate *Essex*, wrote in 1815:

“Here wood is to be obtained, and land tortoises in great numbers, which are highly esteemed for their excellence, and are remarkable for their size, weighing from three to four hundredweight each. Vessels on whaling voyages among these islands generally take on board from two to three hundred of these animals and stow them in the hold, where, strange as it

ALAN ROOT © N.G.S.

Lively lava lizard, five-inch *Tropidurus* warns away rivals on Santa Cruz by doing “push-ups”. Each of the islands’ seven species has its own distinctive version of the territorial display.

First life blooms in “arrested torrents of tormented lava”, as Herman Melville described the Galapagos landscape. Pioneer colonist of barren flows, the cactus *Brachycereus nesioticus* finds a precarious roothold on San Salvador Island.



JOAN ROOT (UPPER) AND ALAN ROOT © N.G.S.

Rosy squadron of rare flamingos sweeps San Salvador Island, cruising toward a salty lake or shallow lagoon where they can feed. The author believes the Galapagos birds, only flamingos known in the Pacific, are a population of West Indian *Phoenicopterus ruber*. He considers them the most endangered birds in the islands because their exposed method of nesting invites destruction of the eggs.

Moisture-starved mockingbirds of parched Española make the most of a bonanza as campers visit their uninhabited island. "We couldn't drink soup or tea without one of them diving into it", recalls Joan Root. "They simply don't know what fresh water is and flock to anything wet. Fearless and curious, they sat on my shoulders and toyed with my ears and hair."

Here attentive callers watch Mrs. Root cut goat meat while a comrade bathes in a pan of water waiting on the primus stove. The Roots hunted wild goats for food during their seven-day stay on Española.

may appear, they have been known to live for a year, without food or water…"

Hundreds of American ships stopped to provision themselves, as did the whaling fleets, sealers, and merchantmen of other nations. Oil hunters slaughtered prodigious numbers for their fat. Settlers, too, took a toll. We cannot accurately estimate the numbers of tortoises taken over the years — certainly hundreds of thousands. The pitiful remnant surviving today — estimated at 8,000 — is a rebuke to human ruthlessness.

Darwin was much impressed that each island should have its own special tortoise, and he filed away this fact in his computer mind. Today, taxonomists recognize as many as 15 subspecies in the archipelago. These are usually regarded as races of a single species.

Pumice Rafts May Have Carried Colonists

But how had they managed to populate the various islands? True, they can swim, but they do so only if thrown forcibly into the sea. Dr. William Beebe tried this many years ago and found that although the tortoise swam easily, it died a week later. He concluded that it might have swallowed too much salt water.

Had the archipelago once been a continuous land mass? Dr. Howel Williams of the University of California at Berkeley and Dr. Allan Cox of the U. S. Geological Survey have found no evidence to support this. Instead, Dr. Cox suggests that the tortoises may have traveled from island to island on rafts of pumice that floated on the sea after volcanic eruptions.

The various races of tortoises divide roughly into two categories: those with deep, rounded shells, and those with more saddle-shaped shells and longer necks. The long-necked varieties live on the more arid islands. During drought periods, when grass was scarce, they were forced to stretch upward to reach fruit, cactus pads, and other food. Perhaps the shape of the shell helped. The individuals that could stretch farthest survived; those with shorter necks did not. Natural selection decreed their form.

The grotesque opuntia cacti, whose weirdly gesticulating branches hold succulent pads high above the ground, are themselves a sermon in evolution. They apparently evolved with the tortoises. On Champion Island, an islet that has never known a tortoise, the cacti are shrubby, with pads and fruit close to the ground. But on islands where tortoises live, natural selection has stretched them into trees (page 580).

Born of volcanic activity, the Galapagos Islands are not as old as one might think. Datings from lava flows show that most of the islands are less than a million years old, and none is much older than two million — not a very long time for such marvels as giant tortoises, marine iguanas, and flightless cormorants to have evolved. But evolution proceeds faster on islands than on continents. The first pioneers find open niches to exploit. With few or no competitors, they adapt and change rapidly.

Having seen the great rafts of vegetation floating down the Guayas River at the port city of Guayaquil in mainland Ecuador, I understood how plants, insects, small mammals, and reptiles could make the long journey to the Galapagos. A flood-borne jungle log could carry its small passengers out to sea and be swept westward by the Peru Current.

Only one successful voyage and landing would be needed each 100,000 years or so to account for the present limited fauna of land mammals and reptiles in the Galapagos. For every successful invasion of the islands, undoubtedly there have been a thousand tragedies. A frog or a salamander, needing fresh water, would not stand a chance; no amphibians are known on the islands. Except for bats, the only native land mammals are ratlike rodents. Most waifs that survived the sea journey probably perished on the arid coast.

Isles Became a Pirate Hide-out

In like manner, most human settlers have been screened out until recent times.

The first European to find the archipelago, Fray Tomás de Berlanga, the Bishop of Panama, set sail from Panama for Peru in 1535. Caught in a calm, his ship was carried westward by the strong equatorial currents until he made a landfall on one of the islands. Seeking badly needed water, shore parties "found nothing but seals… and such big tortoises, that each could carry a man on top of itself, and many iguanas that are like serpents".

The bishop went on to report "many birds like those of Spain, but so silly they do not know how to flee, and many were caught in the hand". This trait of tameness continues today. On the other hand, the animals that should be tame — the introduced goats, cattle, pigs, dogs, and cats — are as wild as the wind.

The islands later became a rat's nest of renegades and buccaneers. In the late 17th century, English buccaneers used the Galapagos as a springboard from which to harass the Spaniards, capturing their ships and sacking their towns in South America.

Of all the islands, Santa Maria, or Charles, has the most bizarre, indeed the most evil, history. I hired a fishing boat to take me there to visit a small colony of flamingos, apparently an outpost population of the rosy West Indian species.

Flamingos are my specialty; I have filmed — on four continents — each of the world's six species, and I was determined to add this colony to my "bag". The Galapagos flamingos, the only ones known in the Pacific, are unquestionably the rarest and most endangered birds in the archipelago (page 556).

I found the flamingos — three dozen of them. Six pairs had built mud nests on a lava ledge by a warm, silty lagoon. The others were engaged in display, fluffing their gorgeous plumes until they looked like gigantic pink chrysanthemums. Stiffly they spread their red wings and wagged their beaks from side to side; this was part of their ritual. Toward evening the mutual admiration society broke up and took wing, scattering to secluded, muddy bays where the feeding was good.

For the next two nights I camped alone between the beach and the lagoon. Small flycatchers came to look me over at arm's length. So did yellow warblers and Darwin's finches, but the absence of mockingbirds seemed strange. I had seen them on all the other large islands. Perhaps cats long ago had eliminated these confiding, curious birds. Tracks of feral cats laced the coarse sand everywhere.

ALAN ROOT © N.G.S.

Dancing the booby hop, a female resident of Española marks time on a rock (from far left) in response to the attention of a male. Rocking from side to side, the blue-footed booby alternately lifts each foot, showing off the handsome color, while her partner spreads his wings and whistles. In a symbolic nest building, they exchange debris. Larger pupils identify the female in these photographs. The couple makes its home on bare ground and cuddles affectionately (below) until eggs are laid.

ROGER TORY PETERSON (ABOVE); ALAN ROOT © N.G.S.

Welcoming a new playmate, sea lions join Richard Foster, *Beagle II*'s mate, as he snorkels for specimens. Fascinated by their strange new companion, the frolicsome mammals toyed with photographer Alan Root's air hose (below), nipped his flippers (right), and nudged him as he dived off Plaza Island. Neither he nor his equipment suffered, despite the vigorous roughhouse. When his air went foul, Mr. Root surfaced to find one of the creatures exhaling its fishy breath at the intake of his air compressor.

As I lay on my back staring at the stars and listening to the braying of distant wild donkeys, I thought of the evil spirits that seem to dominate Santa Maria. I thought of the drunken Irishman, Patrick Watkins, who was the first inhabitant in the early 1800's. A sailor on a British ship, he either asked to be set ashore or was marooned by his ship's master.

Captain Porter of the Essex described Watkins as being of dreadful appearance: "ragged clothes, scarce sufficient to cover his nakedness, and covered with vermin; his red hair and beard matted, his skin much burnt, from constant exposure to the sun, and so wild and savage… that he struck everyone with horror".

This wretch exchanged vegetables for rum from passing ships in sufficient quantities to keep himself intoxicated. His worst habit was to kidnap sailors at gunpoint when they were ashore. Finally he left for Guayaquil in 1809 with an unwilling crew of five such slaves, but he arrived alone. Conjecture persists that he either ate his mates or killed them when water became scarce.

Gen. Jose Villamil, a New Orleans Creole, started a colony on Santa Maria in 1832 with political prisoners from Ecuador. He dreamed of a farming empire upon the fertile, mist-covered slopes. When Darwin arrived three years later, some 300 people were tilling the soil.

Satan came to Eden as Villamil's successor — one Colonel Williams. He flogged the colonists, now reduced in number, hunted the recalcitrant ones with dogs, and for his own safety built himself a palace of lava rock. When his prisoners revolted, he fled. The settlement soon broke up.

In 1870 there was another attempt at colonization by convicts. The tyrant in charge, Señor de Valdizian, was not so lucky. He was murdered. An orgy of plunder, rape, and killing soon led to another abandonment of the unhappy island.

Truly, Santa Maria seemed a place of malignant spirits. During the two nights that I spent in my lonely camp near the beach, I thought often of the dismal procession of the doomed and the damned. It was with relief that I hailed my boatman who was anchored offshore.

Threatened Duncan Tortoises Gain a Reprieve

The early Spanish had called the Galapagos the Enchanted Isles, and true to that tradition, the islands played one of their tricks on us during our return voyage to Santa Cruz. Caught in a capricious current, we sailed for hours, yet could not seem to raise the peaks of our home island. I had the uneasy feeling that we were losing ground to a westerly drift. Night came, and a full moon rose on an empty sea. Eventually the bright moonglow revealed the breaking surf of Santa Cruz. It was midnight before we passed the lighted buoy that marks the entrance to Academy Bay.

The saddleback type of tortoise had never been filmed, and to tell its evolutionary story was one of the most important items on our list. Boarding *Beagle II*, we sailed for Pinzón, or Duncan, Island, seven miles west of Santa Cruz.

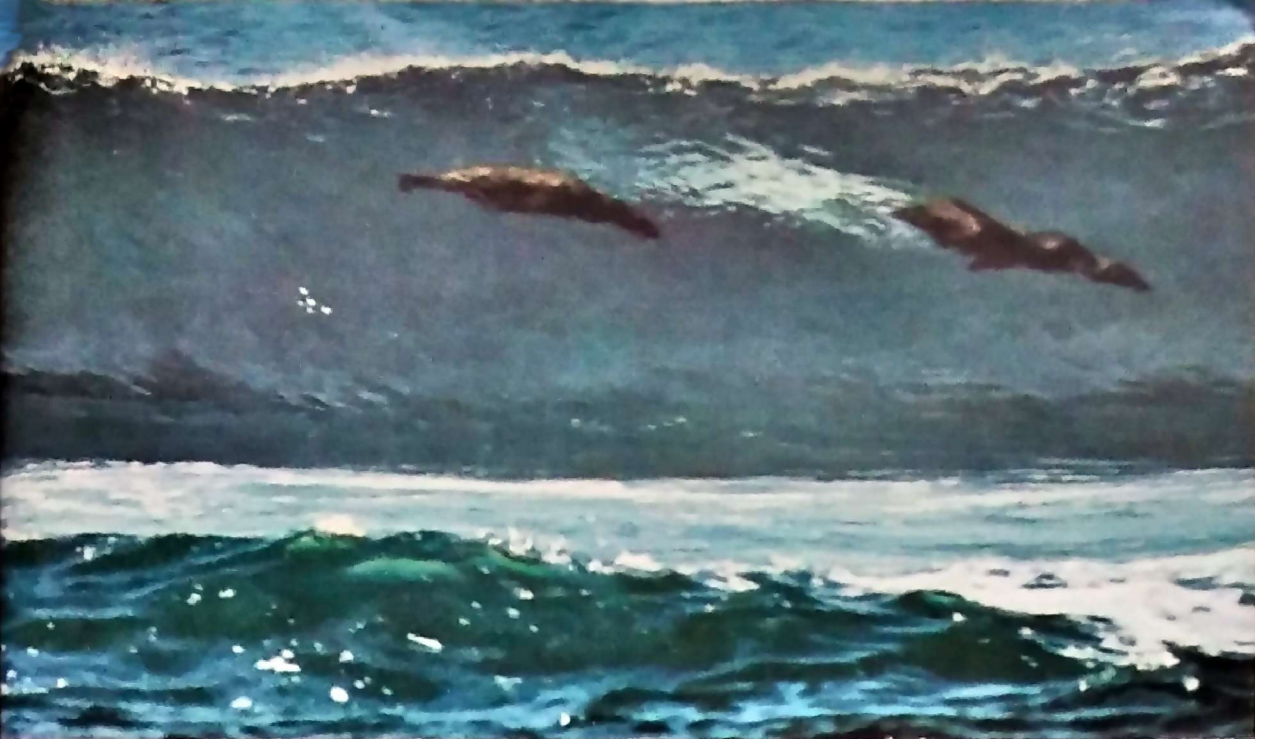
Duncan is a brutal island, a sea-ringed fortress. No poacher in his right mind would land his boat on the precipitous side of the island where the tortoise colony exists. Here perhaps 140 saddlebacks survive, more than half of them marked by Miguel Castro.

Rats seemed destined to wipe out Duncan's ponderous tortoises; no young ones had been seen in this century. But in recent months scientists from the research station have found a way to poison the rats. At the same time, they have been gathering eggs, and now a thriving colony of 32 baby tortoises has been hatched. Soon the new generation will be set free on Duncan, giving promise of a viable tortoise population on the island once again.

Body-surfing sea lions torpedo toward an Española beach. Masters of the sport, they continue their play all day — swimming out about 200 yards to catch another wave as each ride ends. *Zalophus* thrives throughout the archipelago. These close relatives of California sea lions once shared their Galapagos playground with a large population of fur seals, now depleted by hunters for their valuable skins.

Nimble scarlet crabs scavenge the shoreline, cleaning Galapagos beaches of carrion, picking ticks from marine iguanas, and sometimes eating their fellows. Never far from the water, *Grapsus grapsus* seldom ventures into it unless caught by the backwash of a wave or fleeing a predator. This pair appears about half life-size.

FLIP SHULKE, BLACK STAR (BELOW); ALAN ROOT © N.G.S.



Our party, courting disaster, made a landing on Duncan, risking the longboat in the crashing surf. Climbing the steep slope and hacking away with the machete was a nerve-racking ordeal. Tangles of thorn obscured the broken lava. A misstep could mean a gashed shin or broken leg. It took most of a day to locate two of the tortoises and another half day to film them as they steam-rollered their way through the dry brush.

Descending the slope, John Livingston, the organizer of our film unit, slipped and fell 20 feet, catching the force of his fall on the side of his face. His battered and bloody cheek reminded us anew of the utter harshness of these islands, which have screened out all but the hardiest human settlers.

Duncan seems to fit Herman Melville's description of the Galapagos: "In no world but a fallen one could such lands exist". And yet some of the islands qualify as Eden. Plaza Island, an islet off the east shore of Santa Cruz, is such a place — a gem unspoiled by human incursion. Here we dropped anchor in quiet waters while a welcoming committee of sea lions raced alongside the longboat.

Rock-rimmed tidepools made perfect play pens for baby sea lions, protecting them from sharks or killer whales. Large scarlet crabs with pale faces and stalked eyes crawled over the black rocks (opposite). The most remarkable inhabitants were the swallow-tailed gulls, lovely huge-eyed birds that feed at night on squids. They protested my intrusion with curious clicking cries that I suspect have some sonar significance when the birds come in to the cliffs in the darkness (page 578).

On the slopes of this attractive island, sparsely dotted with tree cacti, we found many land iguanas, unearthly-looking creatures that made me think of dinosaurs (pages 580-81). Perhaps 200 of them live on Plaza Island. Unlike marine iguanas, they make good eating, and have been killed off in most of their former haunts. On Baltra Island, where the United States built the landing strip during World War II, land iguanas offered tempting targets to bored servicemen, who wiped them out.

Emergency Ration — Ten Doves a Day

Leaving Santa Cruz and Duncan off our stern, we soon dropped anchor at San Salvador, also known as Santiago or James Island, where Darwin spent a week (map, pages 576-7). Tortoises are now extremely rare here, but it was reported to be the best place for flamingos. In a long green lagoon screened by mangroves, we finally found one lone bird. He honked like a disconsolate goose and occasionally spread black-and-red wings in display. But there were no others to share the glory.

Later we visited a salt mine nearby. For five months no boat had come to supply the men who worked the pit. Out of provisions, they had lived mostly on the island's small wild doves, snaring them and clubbing them with sticks.

Each of these ten men had eaten an average of ten doves a day for three months, consuming a total of 9,000 birds.

"Take us off this Devil's Island", they pleaded. Carl Angermeyer said we would, and a week later, on our way back to Academy Bay, we took off eight of the men. Two elected to stay behind, but later changed their minds and were picked up.

"A Shore Fit for Pandemonium"

The wildest island of all, the weirdest, and the only truly virgin island is Fernandina, the one farthest west in the main grouping. To reach it, we had to cross the Equator and sail around the northern tip of Isabela, largest of the islands, some 80 miles long.

Silvery flying fish fled before the bow of the *Beagle II*, and occasionally a green dolphin skipped over the waves in fast pursuit. Flocks of blue-footed boobies, large gannetlike sea birds (pages 558-9), assembled over schools of anchovies. Wheeling about a hundred feet above the milling fish, they plunged like rockets into the water after their prey.

Recrossing the Equator, we saw to the south our island destination, Fernandina, dominated by a great crater-topped peak. Ambrose Cowley, a map maker aboard an English privateer, *Batchelor's Delight*, named the island Narbrough in 1684. A later misspelling, Narborough, stuck. All the islands once bore English names, but in 1892, commemorating the 400th anniversary of Columbus's voyage to the New World, Ecuador rechristened most of them with Spanish names.

Capt. Robert Fitzroy of H.M.S. *Beagle* had called San Cristóbal "a shore fit for Pandemonium", and his description seemed to fit Fernandina equally well. To him as to members of his crew, Fernandina's black heaps of broken slag appeared utterly barren and desolate. The central volcano, its summit often lost in the clouds, rises to 4,902 feet (pages 538-39). Its sides, studded with lesser craters, have sent flow upon flow of lava snaking down to the sea, obliterating all but a few strips of green.

The one comfortable, indeed, beautiful, spot in all this chaos is at the base of Point Espinoza, where groves of green mangroves rim the

protected bays. On a broad apron of coral sand cast up by the surf we made our shore camp. There we were to spend several days intimately studying the iguanas, the crabs, hawks, sea lions, penguins, flightless cormorants, and all the other unusual creatures of this primordial scene. I had spent ten days there the year before.

Nighttime Visitor Flees With His Wives

I recall vividly my first night on the point. The full moon was up, and after a lamplight repast of soup and fruit juice, I set up my folding cot on the beach, where the breeze would keep mosquitoes away. Hardly had I snuggled into my sleeping bag when I felt a bulky form at the foot of my bed.

I spoke but received no reply. Fumbling with my flashlight, I shot a beam of brilliant light into the glaring eyes and bristling whiskers of a huge bull sea lion. It had mistaken my sea-lion-size silhouette for an invading rival. Whooping and howling, I sent him off down the beach with half a dozen of his cows lumbering behind.

The split tongue of black lava jutting into the sea is the headquarters of the largest colony of marine iguanas in the Galapagos. Hundreds of them, looking like miniature dragons, sprawl in confused heaps in the sun, absorbing the heat retained by the dark rocks (pages 574-5). The marine iguana and the land iguana must have descended from the same pioneer stock. But today one eats cactus, the other algae.

Male marine iguanas guard their harems from enterprising rivals by bobbing their heads in threat. Occasionally they snort, sending a fine spray of brine from their nostrils — suggestive of a dragon belching smoke. The females dig holes in the sandy beach and lay their pair of three-inch-long eggs in February.

On the point, two or three small finches patrolled the mass of sprawling iguanas. Hopping from animal to animal, they gave a peck here, a tug there, apparently gleaning parasites. Stolidly the ugly, wrinkled iguanas allowed the little birds to groom them, flinching only when a sensitive eyelid was tweaked.

LOREN McINTYRE (LEFT); ROGER TORY PETERSON © N.G.S.

Reception committee greets a boatload of sightseers at Santa Fe Island. Tourists sometimes come on a ship that cruises to the Galapagos twice a month from Ecuador.

Old sea lion bulls claim sandy stretches of beach for harems. In contrast to their lighthearted offspring — like the pair nuzzling above — jealous males display hair-trigger tempers. They charge anything that seems to challenge their authority. One gave the author an anxious moment when it mistook his snoozing, sleeping-bag-wrapped form for a rival. Dr. Peterson's shouts frightened the bull away.

Darwin surmised that the marine iguanas occasionally fed on seaweed “at some little distance from the coast”. We now know that they swim out to sea and dive to the bottom, propelled by their flat snaky tails. Divers have seen them at depths of 30 feet, chewing algae on the submerged rocks (page 570).

Playful young seals seem to take great delight in chasing the lizards as they swim frantically for the safety of the rocks. I supposed that, once ashore, the iguanas were without enemies — until one day I saw a Galapagos hawk plop down in their midst. It snatched a young iguana, flew off to a mangrove stub, and ripped its prey apart (page 578). Later I learned that the young must also be wary of snakes (pages 568-9).

We marveled at the tameness of the hawks. They were as trusting as the songbirds and the seafowl. In curiosity they watched us from their low perches, even allowing us to shake the branches until they were forced to let go. They have been virtually eliminated from the two most heavily settled islands, Santa Cruz and San Cristóbal. Nor are they safe elsewhere. One day a visiting yacht dropped anchor at Santa Fe Island and the shore party wantonly shot the four friendly hawks that came to greet them.

One of the great surprises of this tropical archipelago is the presence of penguins. We saw many of these perpendicular birds standing in two’s and three’s on the rocks, or swimming just below the surface, literally flying through the water on stiffly extended wings.

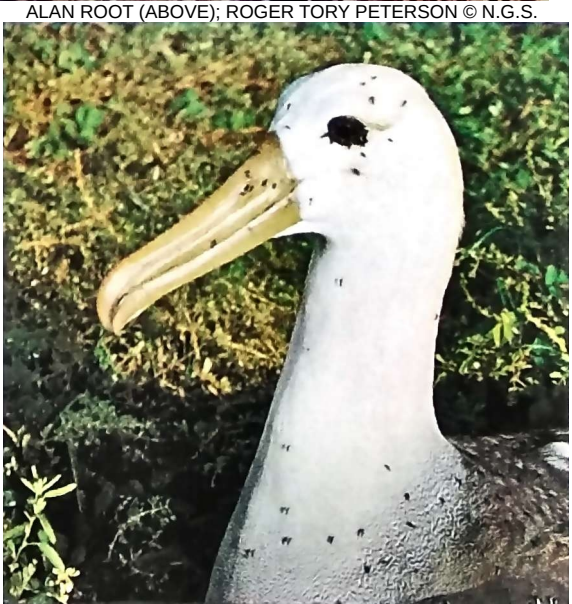
Penguins as a family inhabit the Southern Hemisphere’s colder waters far to the south. But the little Galapagos penguin, numbering between 1,000 and 3,000 birds, lives right on the Equator (page 579). Sometime in the remote past a few birds of the Humboldt penguin type — perhaps inexperienced or adventurous youngsters — must have been swept northward by the cold Peru, or Humboldt, Current, to land far from home on these islands. The breed that has evolved is a small, runty type, but the striped facial pattern of the adults clearly reveals its ancestry.

Lobster Traps Endanger Rare Birds

The most fabulous bird in this never-never land, in my opinion, is the flightless cormorant (page 578). It is more truly flightless than the penguin, for it does not even use its rudimentary wings as flippers. Instead it swims underwater with big webbed feet. Its ancestors, we assume, almost certainly flew, and probably looked much like the Brandt’s cormorants along the coast of California.

These shabby birds sit about in group meditation, occasionally spreading their wings like tattered laundry hung out to dry. Balefully they glare at each other with their green eyes while salt water drips, 12 drops a minute, from their beaks. Like many other sea birds, they possess a special gland in their nostrils to dispose of unwanted salt.

ALAN ROOT (ABOVE); ROGER TORY PETERSON © N.G.S.



Trials of motherhood: A waved albatross sits by as mockingbirds gorge on an egg that has been accidentally cracked. Majestic *Diomedea irrorata*, ranging to the South American coast on wings spanning eight feet, breeds only on arid Española Island. In 1965, a periodic change of climate — caused by a capricious ocean current called *El Niño* — brought mosquito-producing downpours to the island. The stabbing insects clustered about eyes and dug into feathers (right), forcing most albatross mothers to abandon nests.

Reluctant performer, a young great blue heron flees a recording session with Dr. William Gunn, a Canadian naturalist.

When one of the birds finally becomes hungry, it plods across the lava with a stately waddle. Spreading its tiny wings for balance, it hurdles the cracks and crevices with absurd little hops. It jumps into the water feetfirst, like a small boy who has not yet learned how to dive. Then, instantly, the inept creature becomes a master swimmer, cutting the blue depths like a torpedo.

Once while we were watching, a cormorant came up with a squid that had entangled its foot-long tentacles about the bird's face. With an expert toss it flipped them loose and swallowed the squishy squid headfirst.

There maybe fewer than a thousand flightless cormorants in the world, all of them on the shores of Fernandina and Isabela Islands. Even so, we had not regarded the species as in danger until recently. Now these rare cormorants are drowning in lobster traps set out by fishing boats.

The last stop on the agenda of our television crew was Española, or Hood, the southeasternmost of the islands. On my visit the year before, the scrub had seemed quite dead, as if fire had scorched it. We planned to film this desolation to show the damage done by feral goats. Instead, because of the rains, we found a jungle of green — and clouds of mosquitoes. Not even on the arctic tundra have I experienced such bloodsucking hordes. They settled upon us by the thousands, and only a thorough dousing with repellent kept our hands and faces free from their fiery stabs.

I hurried from the beach with anticipation; it was May, and the waved albatrosses would be nesting. This species, with an eight-foot wingspan, has no other breeding place in all the world. But when we walked over the boulders to the colony, we found most of the eggs abandoned.

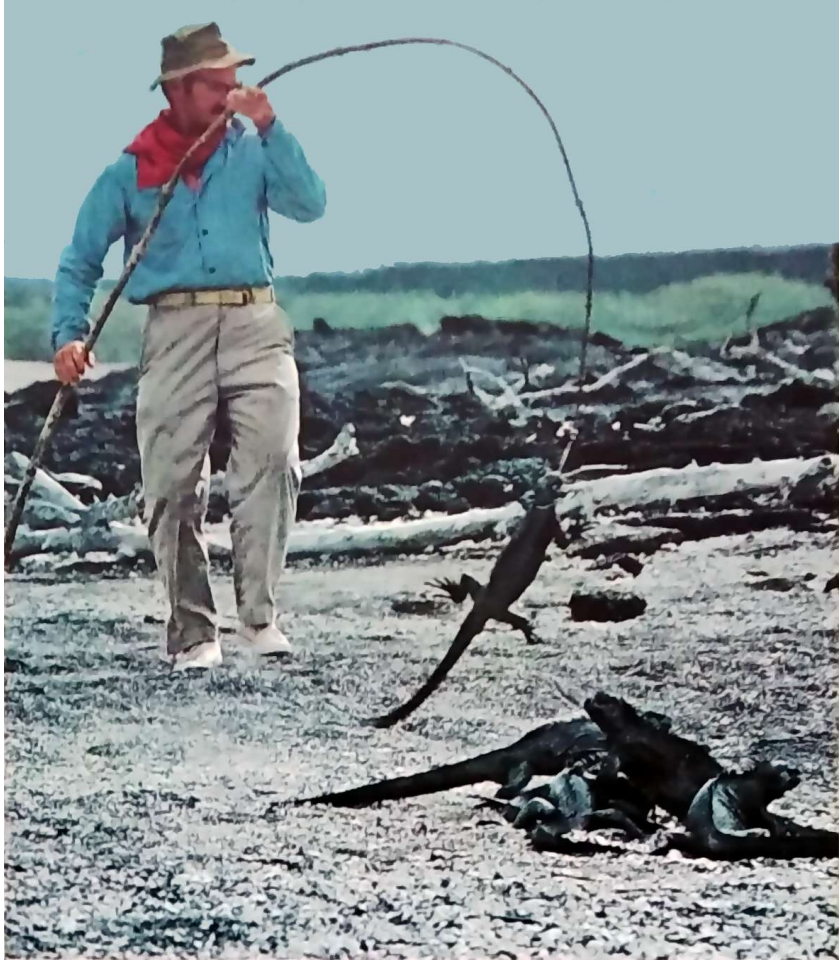
Mosquitoes swarmed about the few dozen albatrosses still trying to stick it out. Hundreds of maddening insects settled on the heads of the great gentle birds. Dozens clustered around their moist eyes (preceding page).

Death overtakes a young iguana as a venomless constrictor pins the ten-inch-long marine lizard with viselike jaws. The snake crushes its victim with powerful coils before swallowing it headfirst (opposite). The seagirt Eden's sole genus of serpent, *Dromicus* apparently poses no threat to mature iguanas. Adults showed no alarm as this predator searched among them for a suitable victim.

ALAN ROOT (BELOW); FLIP SCHULKE, BLACK STAR © N.G.S.

Lassoing lizards on Fernandina Island, Dr. George Bartholomew collects marine iguanas with a noose-tipped pole. He released the captives after taking their temperatures — data that will aid studies on adjustment to environment.

In another project, herpetologist Robert C. Stebbins of the University of California performs surgery on the "third eye" of a lava lizard at Darwin station. Scientists hope to learn how the tiny light-sensitive organs on the lizards' foreheads help them synchronize activities with changes in sunlight.



A few late-arriving albatrosses volplaned in and tentatively engaged in their traditional display. They crossed beaks like rapiers, gabbled at each other, and stood on tiptoe in a formalized dance. But the mosquitoes were too much for them. One by one they shambled away with their rolling mariner's gait to the cliff edge and took off into the clean wind, no longer to be tormented.

We, too, departed Española in a cloud of mosquitoes. I thought with some sadness of the hundreds of albatross eggs that would not hatch this breeding season. Still, most years are dry, and the great soaring birds surely would stage a comeback.

Enchanted Isles Now a National Park

As long as naturalists have been studying these Enchanted Islands, not one species of native bird has disappeared. Nor has a single exotic bird been introduced (except for Bud Devine's macaw). In the future, foreign birds must be excluded at all costs, lest they bring with them diseases to which the island species have no resistance or immunity.

It may be too late to do much about the introduced mammals — the goats, donkeys, dogs, cats, pigs, and rats that have gone wild. They have had much to do with the disappearance of tortoises on some islands and the dwindling numbers of land iguanas.

But man's own destructive proclivities can be curbed. Most of the endangered fauna of the islands has been given legal protection by the Ecuadorian Government, though admittedly enforcement will be a problem.

Ecuador, proud of her famous islands, encourages the new breed of traveler who comes to see, to marvel, and not to destroy. To save the legacy of the past for the citizens of the future, Ecuador in 1965 declared the archipelago a national park. Here the tortoises, the iguanas, and the rare sea birds will always have a haven.

THE END

Sea monster prowls the ocean floor of Fernandina's Point Espinoza. Foot-long nibblers pay the marine iguana no heed as it lunches on brown algae. With equal ease, the big lizards stroll the bottom, hover at mid-depth like submarines, or propel themselves on the surface by sweeping their flattened tails. No one knows how long they can stay under water. But Darwin recorded that one — cruelly weighted down by a sailor — survived an hour's immersion.

EDMUND S. HOBSON © NATIONAL GEOGRAPHIC SOCIETY

After prying out its meal, *pallidus* steadies the tool with a foot (bottom) while swallowing the grub.

"If a bird finds a particularly efficient pick", reports photographer Alan Root, "it retains it, carrying it from tree to tree".

Thus the finch belongs to a select circle of tool-using creatures, including the high-land gorilla which pulls fruit into reach with a branch, the California sea otter which breaks abalones against a rock held on its chest, and the Egyptian vulture which flings stones with its beak to crack ostrich eggs.

Jane van Lawick-Goodall and her photographer husband, Baron Hugo van Lawick, observed the vultures recently in Tanzania. The couple earlier found chimpanzees fashioning crude tools of twigs or stems to "fish" for termites (GEOGRAPHIC, August, 1963, and December, 1965).

ALAN ROOT © N.G.S.

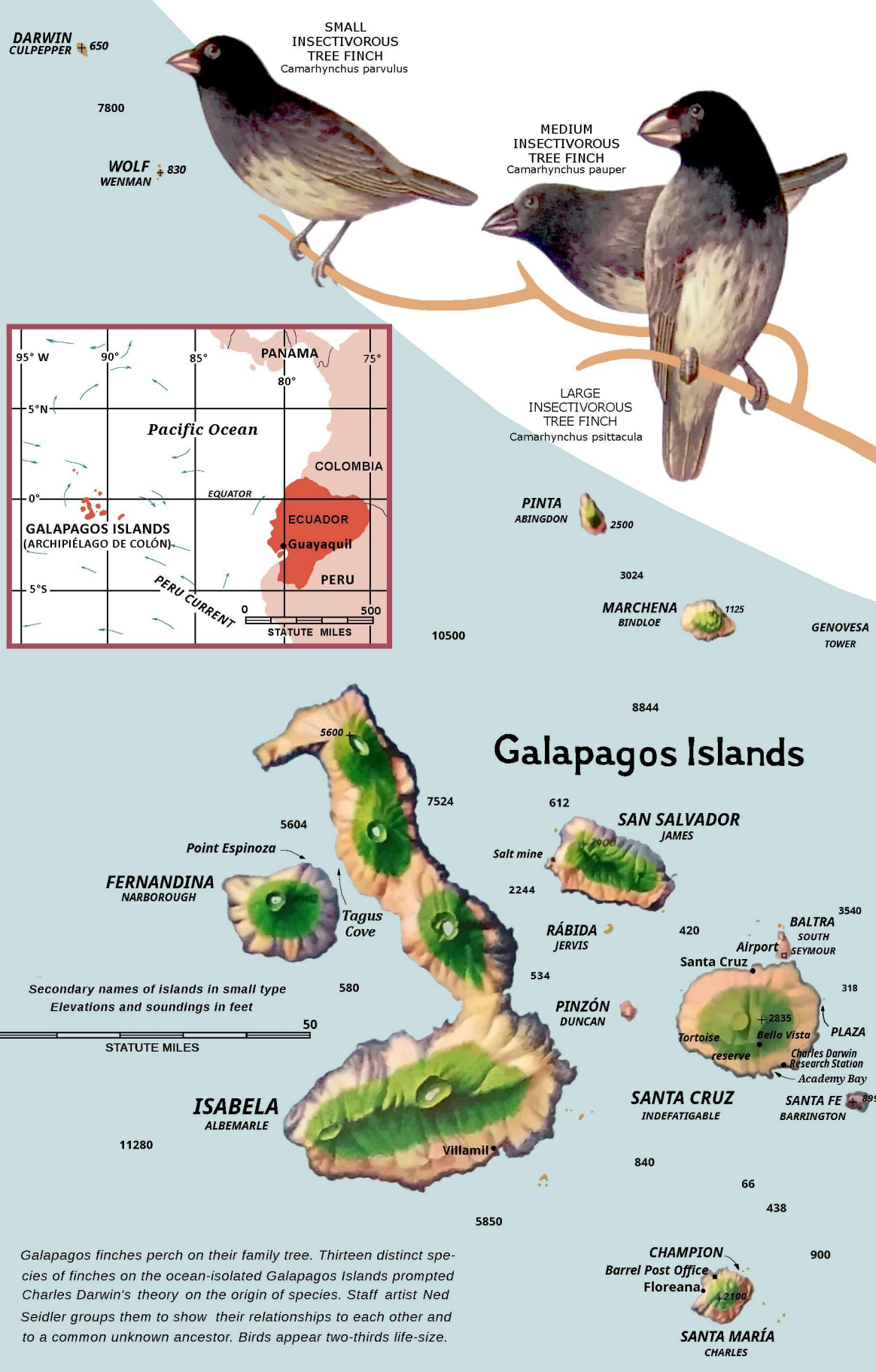
Tool-user goes to work

AMAZING ARTISAN of the feathered world displays a rare talent. The woodpecker finch, *Camarhynchus pallidus*, burrows in trees for meaty grubs. Unlike the woodpecker, however, the finch has neither chisel beak nor long barbed tongue. To make up for this, *pallidus* resorts to an artificial probe; it uses a tool.

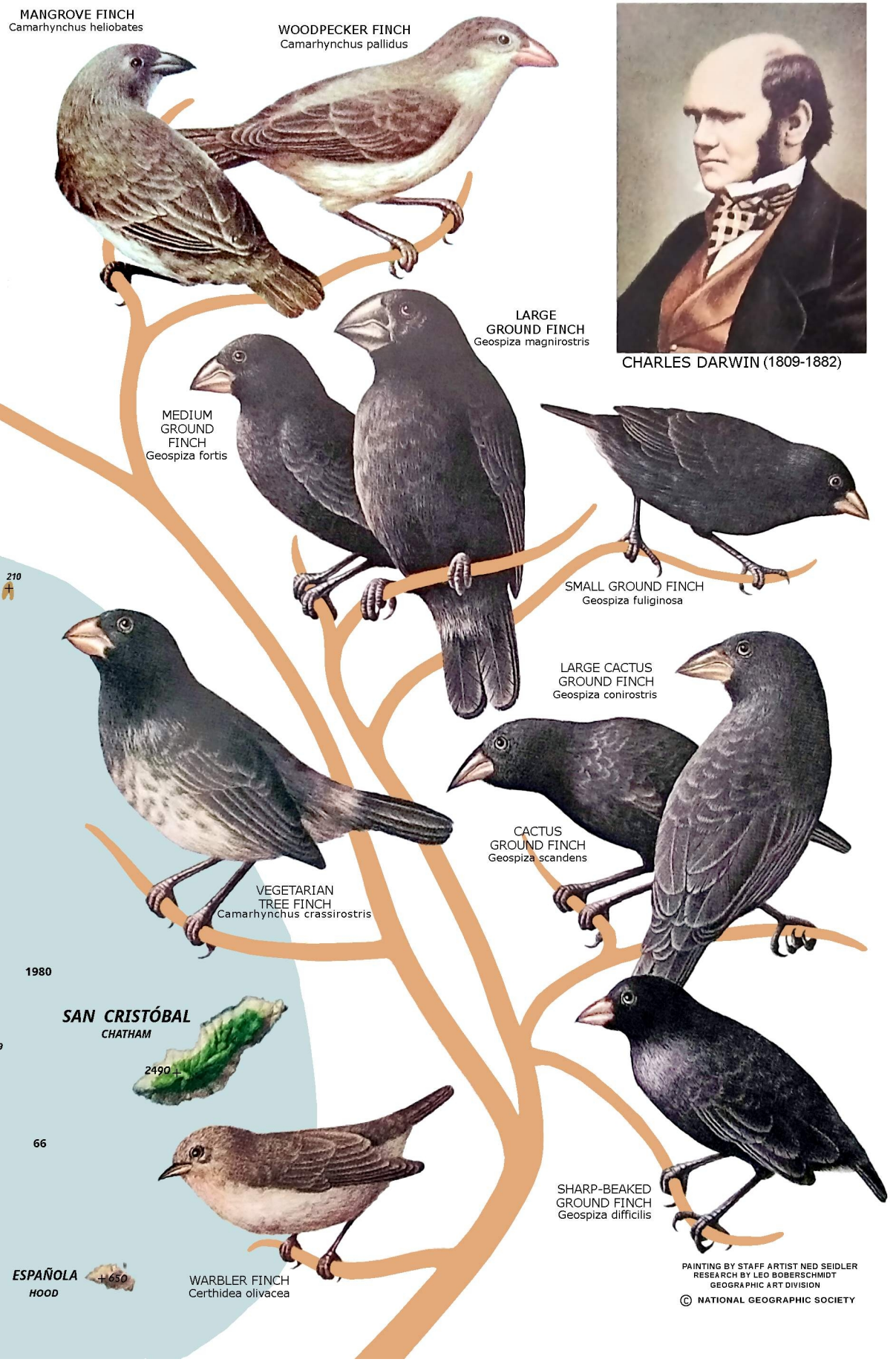
Searching among twigs, the finch (shown life-size above) may break off several before finding a stick of proper size and shape. In these photographs, a woodpecker finch of Santa Cruz Island selects a cactus spine and begins prodding for its dinner (upper right). In the large foldout picture (opposite), the finch slides its beak downward along the spine to pry out a grub which can be seen emerging from the hole.

"FEW ANIMALS ARE UGLIER", *Darwin's captain wrote of the world's only marine iguanas. "They are lizard-shaped, about three feet in length; of a dirty black colour; with … a kind of horny mane upon the neck and back; and long claws and tail". The unique diving reptiles slip from seething colonies like this one at Point Espinoza, Fernandina Island, to graze on algae on the ocean floor (pages 570-1).*

FLIP SCHULKE, BLACK STAR © N.G.S.



Galapagos finches perch on their family tree. Thirteen distinct species of finches on the ocean-isolated Galapagos Islands prompted Charles Darwin's theory on the origin of species. Staff artist Ned Seidler groups them to show their relationships to each other and to a common unknown ancestor. Birds appear two-thirds life-size.


MANGROVE FINCH
Camarhynchus heliobates
WOODPECKER FINCH
Camarhynchus pallidus
LARGE
GROUND FINCH
Geospiza magnirostris
CHARLES DARWIN (1809-1882)
MEDIUM
GROUND
FINCH
Geospiza fortis
SMALL GROUND FINCH
Geospiza fuliginosa
210
LARGE CACTUS
GROUND FINCH
Geospiza conirostris
CACTUS
GROUND FINCH
Geospiza scandens
VEGETARIAN
TREE FINCH
Camarhynchus crassirostris
1980
SAN CRISTÓBAL
CHATHAM
2490
66
SHARP-BEAKED
GROUND FINCH
Geospiza difficilis
ESPAÑOLA
HOOD
650
WARBLER FINCH
Certhidea olivacea
PAINTING BY STAFF ARTIST NED SEIDLER
RESEARCH BY LEO BOBERSCHMIDT
GEOGRAPHIC ART DIVISION
© NATIONAL GEOGRAPHIC SOCIETY

Bit of colored fluff, a vermilion flycatcher watches for insects (below). The islands' only hawk (right), *Buteo galapagoensis* dismembers a young iguana.

DAVID S. BOYER © N.G.S.

ROGER TORY PETERSON

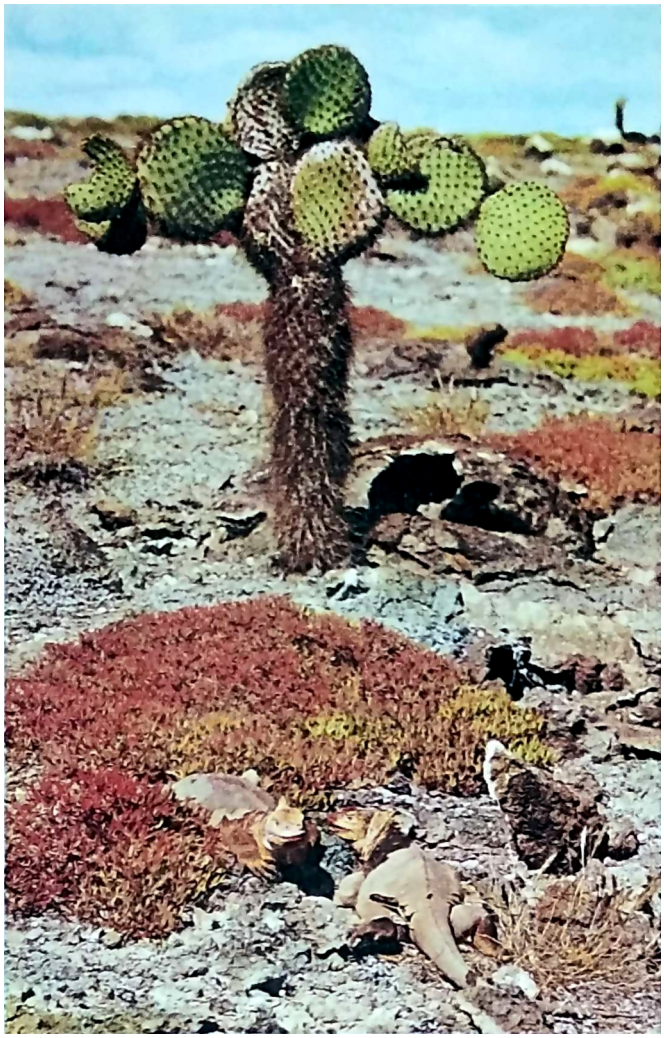
Cooperative colonist from the south, a penguin poses for author Peterson (opposite). Cold waters from the Peru Current help *Spheniscus mendiculus* feel at home on the Equator.

The remarkable tameness of Galapagos creatures, unused to man's presence, permitted the author to make close-up portraits of both the world's rarest penguin and *Creagrus furcatus* (left), a night-feeding swallow-tailed gull. In many instances, he used this camera, designed for copying documents at point-blank range.

Field guides by Dr. Peterson — noted ornithologist, bird painter, and photographer — serve internationally as bird-watchers' bibles.

ABOVE, BELOW, AND OPPOSITE BY FLIP SCHULKE, BLACK STAR

Useless wings and a useful gland distinguish *Nannopterum harrisi*, the Galapagos cormorant. Where fresh water is a rarity, the bird drinks sea water. A salt gland rids its system of excess salt, excreted through its nostrils as brine (above). Earth's only flightless cormorant, the masterful swimmer finds seafood for the taking in the archipelago's teeming waters. Wings serve solely for balance as it waddles to the surf (right). This bird wears a band of the Darwin Research Station.

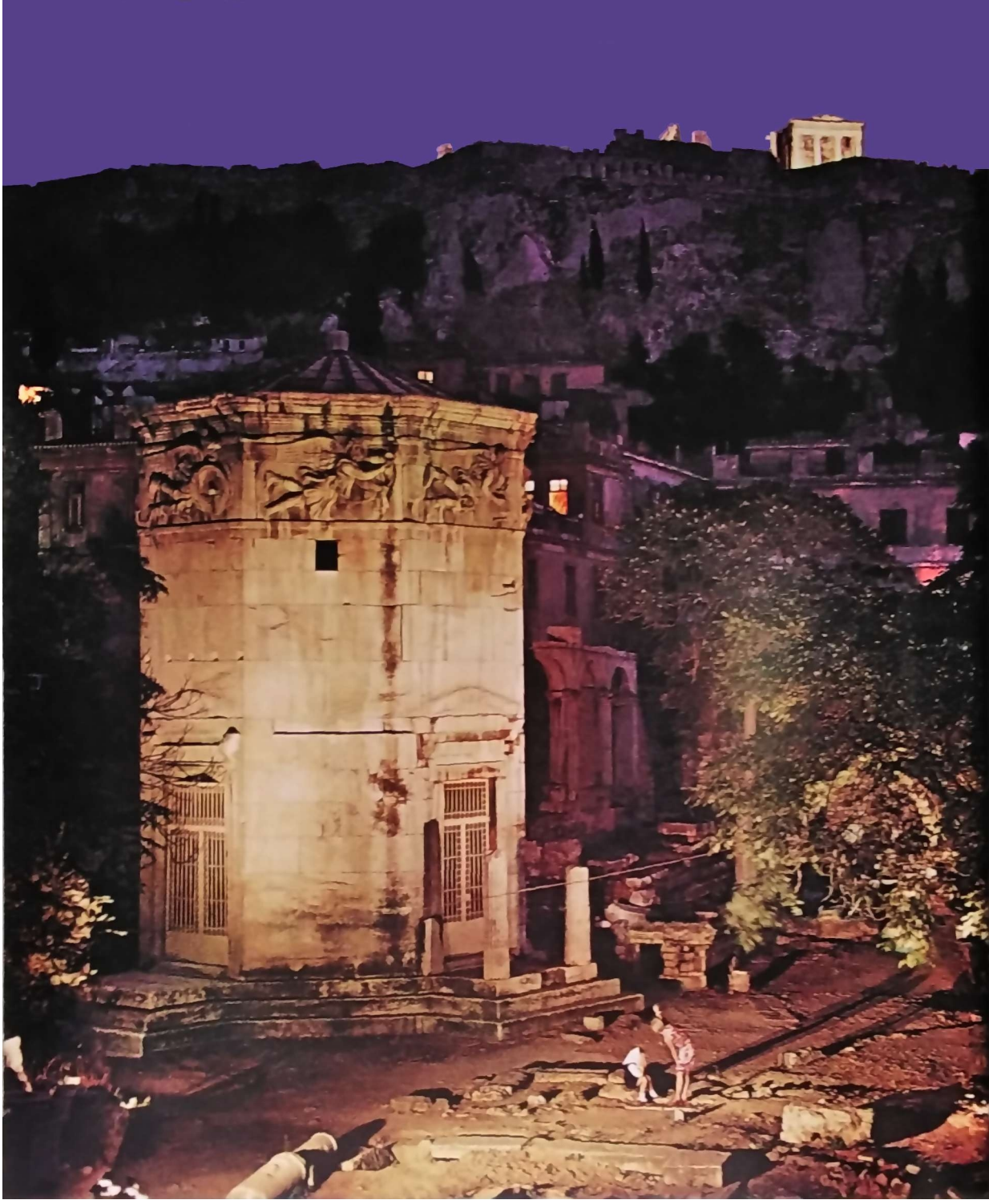


ALAN ROOT © N.G.S.

With unusual fury, land iguanas battle on Plaza Island. Docile except when breeding, males of *Conolophus subcristatus* — like their swimming counterparts, the marine iguanas — stake out territories and warn off rivals. But conflicts seldom reach the violence that bloodies the pair pictured on these pages. The weaker competitor normally breaks away from a head-butting contest before teeth come into play. It drops to its belly to signal submission and retreats tailfirst.

Terrestrial iguanas, slightly larger than their marine kin, range from sea level to the upper slopes of volcanic cones a mile high (pages 538-39). They forage for anything vegetable but subsist mainly on buds and spiny pancake pads that fall from *Opuntia*, the prickly-pear cactus (above and below).

Young prickly pears sheathe their tender trunks with spines. A thick orange bark replaces the protective needles as the trees mature. Where iguanas and giant tortoises feed on the unusual plant, *Opuntia* may tower 30 feet or more. On a few small islands where neither iguanas nor tortoises browse, *Opuntia* takes the form of a low, wide-spreading shrub.



Defying the millenniums, the Tower of the Winds glows in the Grecian night beneath the Acropolis, templed crown of ancient Athens. A Macedonian astronomer, Andronikos of Kyrrhos, built the octagonal structure about 50 B.C., when the Rome of the Caesars ruled Greece. Today it stands as one of the best-preserved buildings of classical antiquity, in dramatic contrast to the ruins of the Roman Agora, or marketplace, at right. Around its top, a carved frieze of winged demigods represents the eight winds, giving the tower its name. The southwest wind, called Lips (right), blew ships into Piraeus, Athens' port.

What did the marble tower hold? An ancient text refers to it as a *horologion* — an "hour indicator". Scholars have long believed that it held an intricate water clock but differ on how it worked. The author, Professor of the History

THOMAS NEBBIA; PAINTING BY ROBERT C. MAGIS © N.G.S.

PIECING TOGETHER
AN ANCIENT PUZZLE

The Tower of the Winds

By DEREK J. DE SOLLA PRICE

Paintings by ROBERT C. MAGIS
National Geographic Staff

IF YOU DON'T PAUSE to browse among the old books or jumbles of antique brass and copper in the shops of Pandrosou Street, it takes only ten minutes to walk from Constitution Square, heart of modern Athens, to the foot of the ancient Acropolis. But even in this city, where antiquity abounds, my short stroll on a cool October morning spanned 20 centuries with spine-tingling suddenness.

As I left the narrow back streets, the clamor seemed to fade abruptly. To my left and beyond, the Plaka quarter — a maze of beguiling lanes and romantic *tavernas* smelling of spices and resinated wine — nestled against the sheer rock wall of the Acropolis.

Directly ahead lay the Roman Agora, or market-place — a large city block of marble floors, fallen stones, and column stumps, sparsely covered by a mantle of grass and brush. The calm of morning made it difficult to visualize this quiet island as a hub of activity when the Caesars ruled Athens from Rome, near the beginning of the Christian Era.

Amid the ruins stood my destination, the Tower

of Science at Yale University and a specialist on ancient scientific instruments, recently visited Athens on a National Geographic Society research grant to study the tower anew. Using meager clues painstakingly gleaned from the tower's interior, he and Joseph V. Noble, art historian and Vice-Director of the Metropolitan Museum of Art, here present their theory.

of the Winds. A small red sports car parked near the Agora's east gate told me that photographer David Beal and his wife Dawn, Australian residents of Athens, had arrived early for our appointment. Only George Stuart, draftsman on the National Geographic staff, was missing. He soon appeared from the ruins of the Agora colonnade, laden with measuring instruments and notebooks.

Our meeting here sealed acquaintances begun through letters written months before, when the National Geographic Society had agreed to support our research project at the Tower of the Winds. We would spend this first day inspecting the Agora and the unusual eight-sided building that had brought us here.

Whirling Dervishes Left Their Mark

The Tower of the Winds stands like a large, ornate canister, a blatant non-ruin yellowed with the patina of 2,000 years (pages 582-3). A Macedonian astronomer, Andronikos of Kyrrhos, fashioned it around 50 B.C. as an astronomical wonder as well as a timepiece for the marketplace.

On each wall, just under a sculptured demigod representing one of the eight winds, a sundial spread its web of lines. An early text tells of a bronze wind vane in the form of Triton, son of the sea god Poseidon, that turned on the roof and pointed to the image of the wind that was blowing.

Paradoxically, the true wonder of this building lies in its missing furnishing: Inside the octagonal chamber, scholars believe, an ingenious water clock once rested. We had come to try to puzzle out the details of this lost device.

By the second morning the Director of Antiquities, Dr. Nicholas Platon, had approved our research permits. The four of us, quiet with anticipation, gathered at the northwest entrance. I unlocked the metal-grille door and swung it open. We crossed a well-worn threshold to the interior of the tower.

Inside, piles of broken sculpture—staring marble heads, robed torsos, and architectural ornaments from the nearby ruins—gave silent hint of the once proud aspect of the Agora (page 586). The age-stained walls told later history: Early Christians had scratched a small cross on one stone. During Turkish rule of Greece in the 18th century, whirling dervishes had carved a prayer niche in the angle at the left of the south wall, in the direction of Mecca.

It was during Turkish rule, also, that pioneer British archeologists James Stuart and Nicholas Revett excavated the rubble fill (including human bones) that the traffic of centuries had packed into surface called the dervish floor, exposing a system

Showcase for the ancient clock rises from a stepped marble base on a sunny morning 2,000 years ago. Surveyor at left sights toward his chainman, while astronomer Andronikos carefully lays out a sundial for the exterior. Slender columns, collared with transport rollers, await raising, then fluting. Workman ladles molten lead over bronze clamps that bind the stones. A block and tackle creaks a stone aloft, and a gesturing city official discusses the project with a foreman. Beyond this busy scene, merchants begin to crowd the Agora. Authorities on the ancient marketplace suggest that the east gate at this time — about 50 B.C. — bore the simple Doric columns shown and not the Ionic capitals that later graced it (page 587).

Stonemason's grooves may still be seen in the tower floor (right). The author inserts a fragment of guardrail, found amid ruins of the Agora, in a trench marked by yellow chalk. Channels dusted with blue chalk led to three fountains, the author believes, that played around the completed horologion (following pages).

PAINTING BY ROBERT C. MAGIS; DAVID BEAL, BLACK STAR © N.G.S.

ΒΟΡΕΑΣ
ΚΑΙΚΙΑΣ

PAINTING BY ROBERT C. MAGIS; DAVID BEAL, BLACK STAR © N.G.S.

Masterwork of science and art, the Tower of the Winds appears as it must have looked in its heyday during the 2d century A.D., in this painting based upon Dr. Price's research. On the roof a bronze Triton points the direction of the wind; the original vanished long ago, as did the clockwork. Ionic columns now guard the rebuilt east gate of the Agora in this scene (compare page 585). The old quarter of Plaka, still a living part of Athens, nestles under the walled Acropolis. The tower became a place of worship, first for Christians and later for whirling dervishes. Today it shelters fragments of Agora sculptures — battered relics of a brilliant era (left).

of holes and grooves in the original marble floor. These, they reasoned, must have held the works of some sort of water clock.

Here the state of knowledge had rested. Though several floor plans of the tower had been published, none was complete. We would take up the matter afresh, hoping our efforts would result in a workable mechanism, on paper, of the clock of Andronikos.

Quest Focuses on 1st Century B.C.

The problem was akin to re-creating the workings of a suburban kitchen in an empty room, using the relative positions of electric sockets, pipe holes, and rectangular floor stains as evidence. Such clues would be meaningful only with some knowledge of modern kitchen equipment. Similarly, we would have to apply what we knew of the mechanisms and technology of the 1st century B.C. to whatever clues we might find in the tower.

What did archeology tell us of water clocks?

Excavations in Athens' older Greek Agora nearby had revealed traces of a building that evidently held such a device as early as the 4th century B.C., the time of Aristotle.

In 1900, sponge divers found the remains of a boat off Antikythera Island in the Aegean. Among its cargo were precious fragments — clusters of clockwork gearing from an astronomical computer. Its date: about 80 B.C.

Add to these discoveries a fragment of an astronomical clock dial of a slightly later period that survives in a Salzburg museum (page 590), and a few descriptions by such classical scholars as Vitruvius, Varro, and Hero, and a mosaic of fact begins to emerge.

A water clock of this period, we felt, would include several major elements: an elevated reservoir constantly filled with water; beneath it, a pot or tank into which water would drip at a carefully controlled rate; a float-chain-and-weight mechanism that turned an axle as the water level rose in the pot; and an astronomical "clock face" that revolved like a wheel at the end of the axle (pages 588-89). Unlike modern clocks, it would have no hands; the position of the sun on the slowly revolving dial would tell the time of day.

If, as we believed, these parts once existed, they had long since vanished. We could hope to find only where they might have stood.

We spent the first week on our knees, house-cleaning the dusty, crowded storeroom. Ours was an archeological expedition without shovels. Instead, Dawn Beal brought a bucket, brushes, and — for cleaning out drain holes — a plastic-handled potato peeler.

Great timepiece, guarded by the trident-bearing sea god Poseidon, traces the sun's daily journey and the passing of the seasons. Cutaway painting re-creates the ancient marvel as deduced by the author and Mr. Noble.

Water piped from a brackish spring high on the Acropolis flows through the longest pipe, at far left, to fill the large reservoir. A short pipe leading from the bottom of the reservoir controls the clock's ponderous "mainspring" — a bronze water tank containing a float. Water under constant pressure drips into the smaller tank and slowly lifts the float. This slackens a chain running through pulleys to a sandbag counterweight behind the clock face. The sandbag descends gradually — an action that turns the clock disk. Every 24 hours an attendant enters the annex and drains the bronze tank, thus resetting the timepiece.

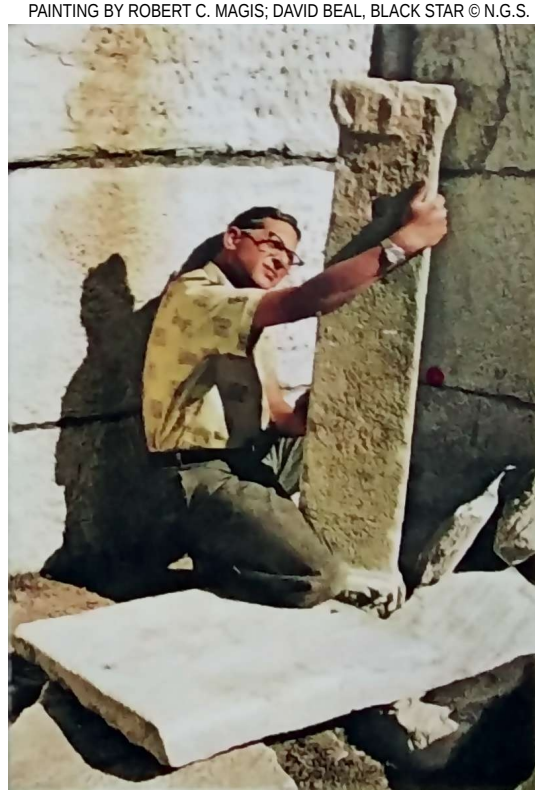
Overflow from the large reservoir drains through the middle pipe and into the main chamber, where it spurts out into the three fountains.

Andronikos's sundials served Athenians as both timepieces and calendars. The shadow from the spikelike gnomon on the left dial, swinging across radial lines, tells the hour — here about noon. Length of the shadow, as measured by the cross lines, tells the season — near midsummer.

On the east face at center, the gnomon's shadow lengthens as the morning sun climbs; thus the horizontal lines measure the hour, the vertical lines the seasons. As the sun descends in the western sky, dials on other faces take over.

Dr. Price (below) examines stones found in the cylindrical annex that held the reservoir.

PAINTING BY ROBERT C. MAGIS; DAVID BEAL, BLACK STAR © N.G.S.



Pie slice of the heavens — as the ancients knew them — broke from a bronze clock face of about the 2d century A.D. and served as a guide in re-creating the tower's clock (opposite). Found about 65 years ago amid Roman ruins in Salzburg, Austria, this fragment, here shown about one-half actual size, bears the mythological figures of constellations: the robed Andromeda at left, her sword-wielding husband Perseus, and Auriga the chariot driver. The saw-toothed edge cuts through the zodiacal signs of Pisces the fish, from upper left, Aries the ram, Taurus the bull, and Gemini the twins. Curved side of the fragment was shattered from the disk along holes that marked the sun's apparent path through the heavens. The intact disk portrayed on the opposite page shows the path as a line of perforations.

CLOCK-FACE DETAIL COURTESY SALZBURGER MUSEUM CAROLINO-AUGUSTEUM, PHOTOGRAPHED BY ROBERT C. MAGIS; PAINTING BY ROBERT C. MAGIS © NATIONAL GEOGRAPHIC SOCIETY

Constellations in the guise of heroes and mythological creatures parade across the clock face in the tower of Andronikos. Precisely turned by the water-controlled mechanism, the disk revolves clockwise behind a stationary grid of hour zones held by legendary strongmen, Atlas and Hercules. Astronomer Andronikos lectures in the torch-lit chamber as his students take notes on wax tablets.

The sun, not the earth, moved through the heavens, the Greeks believed; therefore Andronikos bored holes in his disk in the shape of the apparent solar path, or ecliptic. Farthest point of the orbit, seen here at the top of the disk, marks midwinter. Every two days an attendant moved the golden sun marker to the next hole to keep pace with the seasons.

The Greeks divided the day into 12 equal hours and night into another 12. Thus hour lengths varied as days grew longer or shorter. On the grid marking the hours, a horizontal wire — here shown as red — divides daylight and darkness, and a vertical meridian wire, also red, designates noon and midnight. The sun — 2 ½ hours after sunset — rides in a hole representing a date in early August. A relatively short nighttime journey will bring the sun — the clock's "hour hand" — above the horizon wire for a longer sweep through daylight hours. By causing disks to rotate as the sun appeared to move, ancient Greek clockmakers perhaps set the pattern by which today's timepieces turn "clockwise".

As we freed each area of its mantle of dirt, George measured and plotted, and David recorded the work on film. The piles of sculpture, of course, hampered us greatly. These had to be carefully shifted each time we finished an exposed section of floor. As we spent days sweeping, scraping, and measuring, our paper floor plan gradually took shape. Most of it agreed with earlier sketches of the octagonal main room and its small cylindrical rear chamber, but we mapped several important additional details.

In the floor of the cylindrical chamber, I noted, the stone joints had been reinforced by bronze clamps covered with lead. Something heavy had rested here — the clock's water tank? Nearby, a groove ran up the wall; it could have been occupied by a lead pipe, carrying water under pressure into an overhead reservoir. A rectangular hole in the floor of the chamber would have served admirably to "reset" the clock: Each dawn a custodian would simply drain the tank, thereby lowering the float and automatically turning the clock face backward to the start of another day.

Channels in the floor of the main room showed where overflow ran to three fountains. A circle of shallow grooves, we reasoned, supported a railing that kept curious spectators out of reach of the bronze clock face. But an extra groove and part of another, inside the larger circle, baffled us. We finally concluded that here a mason had blundered; his error had survived 2,000 years in silent reproach.

Jigsaw Puzzle Yields to Patience

At each day's end we gathered in the lengthening shadow of the tower to discuss our progress and the inevitable puzzles. On these clear Athenian evenings, the spell of the building and its setting became almost palpable. When the mass of the Acropolis flattens to a black shape against the sky and the breeze brings hints of music from awakening Plaka, it takes little imagination to hear the idle murmur of Andronikos's tired workmen as they clean up the day's debris and disperse into a similar evening 2,000 years away.

By week's end we had an exact floor plan of the tower. Armed with this, and with intuition, we began our search for elements that would fit the depressions in the floor. Some had previously been discovered. The Agora was littered with other possibilities. After centuries of random gathering and piling, where would pieces from the tower be?

"There". David's hand made a panoramic gesture. "I asked the Agora custodian, and that's what he said".

We paired off to search among the heaps of stone, returning time after time, staggering under heavy pieces that looked as if they matched the holes and grooves in the floor — but didn't. Our discouragement deepened.

"This one must fit". David wrestled a piece of curved marble lattice into place along the circle of grooves. "Nothing else does".

It did (page 585). And just as it clicked into place, I remembered two similar fragments among the sculpture in the tower — enough for George to estimate the probable height of this railing: about 42 inches, or roughly elbow level.

Clock Told Wonders of the Universe

Bit by bit, first on the site, later with my collaborator, art historian Joseph V. Noble of the Metropolitan Museum of Art in New York City, we fitted together the evidence that shaped our concept of the reconstructed clock (paintings, pages 588 and 591).

Two generations before Christ — the age of Caesar, Cleopatra, Mark Antony, and Octavius — the tower's shaded porticoes beckoned a crowded marketplace. A visitor entering the cool, shadowed room was rewarded by an unforgettably striking spectacle.

As I visualize it, within the circular railing at center, set off by fountains and statuary that loomed in the half-light, turned a bronze disk — a model of the universe moving in harmony with reality. Among Andromeda, Perseus, and the figures of the zodiac, a golden sun, pegged into the proper hole for the time of year, moved behind a wire grid which indicated the hours of day and night and the lines of the horizon and meridian.

Any detracting sounds of the concealed machinery must surely have been lost in the spectator's awe. Truly the chamber was a place to deepen the thoughts of men, whether they entered as merchant, artist, or passer-by. This was no simple timepiece. It was a showpiece, a symbol of intellectual triumph that proclaimed man's mastery of science. And who among its builders could know where that mastery would lead: to the scientific revolution of the 17th century; later, to the Industrial Revolution; and now, today, to the threshold of boundless space.

Notes on this electronic edition:
– digitized in 2024;
– some pages inside a subject were reordered to prioritize main text;
– advertising pages were suppressed (including back cover);
– the pages were renumbered automatically from page 449 (actual number); references to pages were modified to point to the new numbers;
– the Future Washington map, due to its complexity in a small size (three pages), was tweaked to improve visualization of details; some text and numbers were repositioned to not destroy structures; the image was cleaned and improved from the photograph of the pages. Due to its fine details that can only be seen with great magnification, the image is also on a separate file.
– the fragment of the disk on pages 590-1 has the lines improved for better visualization. A drawing of the figures can be seen in this image in Wikimedia Commons.